

F. J. Lowe

IAGA



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INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS
ASSOCIATION OF GEOMAGNETISM AND AERONOMY

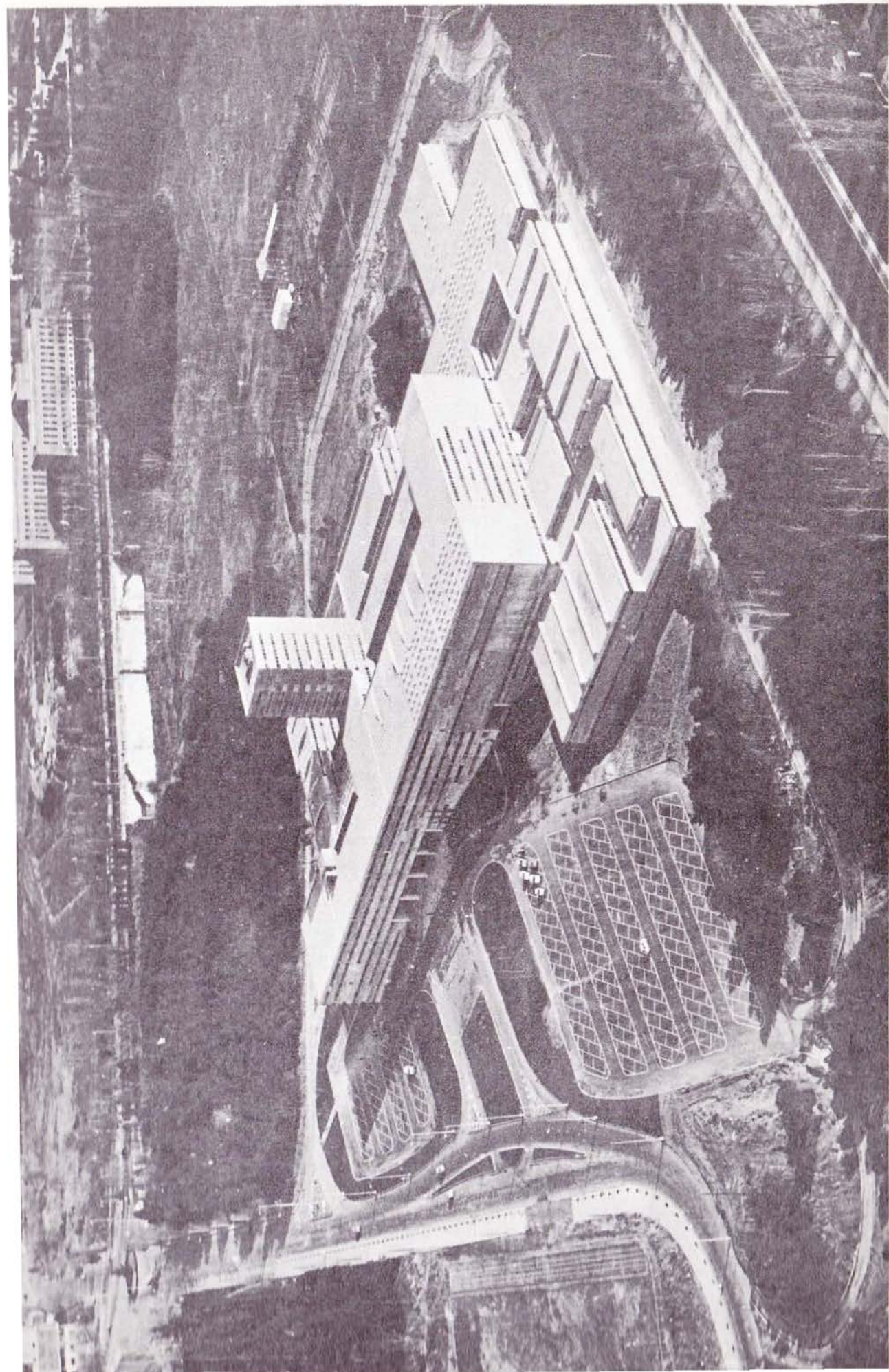
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Escuela Técnica Superior de Ingenieros de Caminos
Site of IAGA General Scientific Assembly
Madrid, Spain 1969

I GENERAL INFORMATION

The IAGA held a General Scientific Assembly in Madrid, Spain on 1-12 September 1969. On this occasion both IAGA and IASPEI were guests of their Spanish hosts lead by the following Local Organizing Committee:

President:	Rev. Fr. A. Románá, S. J.
Secretary:	Dr. Ing. J. M. Munuera
Vice Secretary:	Dr. Ing. L. de Miguel
Treasurer:	Prof. J. M. Gamboa
Members:	Rev. Fr. J. O. Cardús, S.J.
	Dr. Ing. J. M. Bonelli
	Prof. J. M. Torroja

During the first week each Association held independent sessions with its own scientific reports and symposia. In the second week there were joint meetings with symposia on subjects of interest to both Associations as well as additional separate meetings by each Association.

All the sessions were held in the Escuela Superior de Ingenieros de Caminos, Canales y Puertos, located in the University City of Madrid (see frontispiece on opposite page). The sessions lasted from 9 to 12 in the morning and from 16 to 19 in the afternoon. Business meetings of the working groups of IAGA were held from 12:00 to 13:30 during week day.

Appreciation is given to Father Románá and his committee which made all the delegates and their guests feel very welcome in Madrid. IAGA is also very grateful for the secretarial services and facilities provided by the local committee.

Four hundred and sixty scientists registered in Madrid for the IAGA assembly. The program for the assembly which is available from the IUGG Publications Office, 39 ter, rue Gay Lussac 75, Paris Ve, France, as IAGA Bulletin No. 26 for \$7.50 shows there were 483 papers submitted for presentation by 625 authors. These figures include the 57 papers presented in the three Symposia which were jointly sponsored by IAGA and IASPEI (the UMC also cosponsored two of these Symposia).

During the Scientific Assembly only a minimum of administrative items were handled. Chiefly among these were discussions regarding a French proposal to reorganize several of the Unions within ICSU to decrease the overlap of Unions working the aeronomy, space and solar-terrestrial physics fields.

Appreciation is given here to the following scientists who gave freely of their time during the Scientific Assembly in Madrid in helping with

resolutions:

Resolutions Committee

Rev. J. O. Cardus, S.J., Chairman

Dr. E. Selzer

Mr. K. L. Svendsen

Thanks also goes to all of the Commission Chairmen and Working Group Reporters. An extremely good response was received from these IAGA Officials. Almost all of them submitted written reports of their work during the Assembly before they left Madrid, so that the final Transactions (IAGA Bulletin No. 27) can be prepared without delay.

It was decided that the publication and dissemination of this IAGA News would be the best way of quickly getting the Resolutions to the right parties.

At the IUGG Executive Committee meeting held in Madrid on 13-14 September 1969, Professor Liviu Constantinescu, Acting Research Director, Centre for Geophysical Research, Bucharest, Romania was elected as Vice President of IUGG to serve until the XV General Assembly in place of the late Dr. Kuno of Japan.

II IAGA RESOLUTIONS FROM MADRID

RESOLUTIONS OF THANKS

A

L'Association Internationale de Séismologie et de Physique de l'Intérieur de la Terre et l'Association Internationale de Géomagnétisme et d'Aéronomie prient

Monsieur le Vice-Président du Gouvernement
Monsieur le Ministre de l'Education et de la Science
Monsieur le Ministre de l'Information et du Tourisme

d'accepter l'expression de tous leurs remerciements pour l'intérêt personnel qu'ils ont porté aux problèmes de l'organisation des deux assemblées scientifiques générales et pour les moyens qu'ils ont fournis à l'organisation des deux Congrès à Madrid du premier au douze septembre 1969.

The International Association of Seismology and Physics of the Earth's Interior and the International Association of Geomagnetism and Aeronomy express their warmest thanks to

The Vice President of the Spanish Government
The Minister of Education and Science
The Minister of Information and Tourism

for the personal interest which they have taken in the organizational problems of the two General Scientific Assemblies, and for the support which they have given to these assemblies in Madrid from the 1st to the 12th September 1969.

B

L'Association Internationale de Séismologie et de Physique de l'Intérieur de la Terre et l'Association Internationale de Géomagnétisme et d'Aéronomie adressent leurs plus vifs remerciements au Conseil Supérieur des Recherches Scientifiques et à son Président le Professeur M. Lora-Tamayo pour le soutien direct apporté à l'organisation des deux Congrès par un secrétariat très effectif dès l'origine et pour le travail constant qui a conduit au développement harmonieux des deux assemblées scientifiques générales à Madrid du premier au douze septembre 1969.

B. (Continued)

The International Association of Seismology and Physics of the Earth's Interior and the International Association of Geomagnetism and Aeronomy warmly thank the Superior Council for Scientific Research and its President, Professor Lora-Tamayo for the direct support given to the organization of the two general scientific assemblies by means of a secretariat which was highly effective from the start, as well as for their constant work which led to the harmonious development of these assemblies in Madrid from the 1st to the 12th September 1969.

C

L'Association Internationale de Séismologie et the Physique de l'Intérieur de la Terre et l'Association Internationale de Géomagnétisme et d'Aéronomie adressent leurs sincères remerciements à l'Amiral J. Garcia-Frias Directeur de l'Institut Géographique et aux membres de son Institut non seulement pour leur préparation adéquate des deux assemblées scientifiques générales à Madrid du premier au douze septembre 1969, mais également pour leur participation active à l'organisation quotidienne des séances scientifiques.

The International Association of Seismology and Physics of the Earth's Interior and the International Association of Geomagnetism and Aeronomy sincerely thank Admiral J. García-Frías, Director of the Geographic Institute, and the other members of this Institute both for the excellent preparation of the two general scientific assemblies in Madrid from September 1 to 12, 1969, and for their active participation to the daily organization of the scientific meetings.

D

L'Association Internationale de Géomagnétisme et d'Aéronomie et l'Association Internationale de Séismologie et de Physique de l'Intérieur de la Terre prient M. le Recteur de l'Université de Madrid et M. le Directeur de l'Ecole Supérieure des Ingénieurs des Ponts et Chaussées de croire à leur gratitude pour les locaux universitaires mis à leur disposition et en particulier pour les nombreuses facilités de la Escuela Técnica Superior de Ingenieros de Caminos Canales y Puertos.

D. (Continued)

The International Association of Seismology and Physics of the Earth's Interior and the International Association of Geomagnetism and Aeronomy sincerely express their gratitude to the Rector of the University of Madrid and the Director of the Advanced Technical School for Highway Engineering for the use of the University buildings and in particular for the use of the numerous facilities of the above mentioned school.

E

Les participants aux assemblées scientifiques générales de l'Association Internationale de Géomagnétisme et d'Aéronomie et de l'Association Internationale de Séismologie et de Physique de l'Intérieur de la Terre sont heureux de pouvoir exprimer au Réverend Père Romaña, S.J., Président et à tous les membres du Comité d'Organisation des Assemblées Générales Scientifiques IASPEI/IAGA 1969 de Madrid, leurs sentiments de gratitude pour l'accueil exceptionnel qui leur a été accordé, en les priant de croire qu'ils en conserveront le meilleur souvenir.

The scientists participating in the General Scientific Assemblies of the International Association of Seismology and Physics of the Earth's Interior and the International Association of Geomagnetism and Aeronomy are happy to express to the Reverend Father Romaña, S.J., President of the Organizing Committee and to all the members of his Committee, their gratitude for the exceptionally fine reception which they have received. They will keep a warm remembrance of it.

F

L'Association Internationale de Géomagnétisme et d'Aéronomie et l'Association Internationale de Séismologie et de Physique de l'Intérieur de la Terre désirent exprimer à Monsieur le Maire de Madrid leurs chaleureux remerciements pour la réception qu'il a offerte dans les Jardins de Cecilio Rodriguez aux délégués des deux Associations et à leurs familles à l'occasion des deux assemblées scientifiques IAGA/IASPEI à Madrid du premier au douze septembre.

F (Continued)

The International Association of Seismology and Physics of the Earth's Interior and the International Association of Geomagnetism and Aeronomy express their warm thanks to the Mayor of Madrid for the reception which he gave for the participants to the Assemblies and their families in the Cecilio Rodríguez Gardens during these Assemblies in Madrid, from September 1 to 12, 1969.

G

Les épouses des participants aux assemblées scientifiques générales de l'Association Internationale de Géomagnétisme et d'Aéronomie et de l'Association Internationale de Séismologie et de Physique de l'Intérieur de la Terre sont heureuses de pouvoir exprimer leurs sentiments de reconnaissance aux Dames du Comité Espagnol pour leur sollicitude de chaque jour à l'occasion du Congrès de Madrid.

Elles demandent également d'associer leurs époux et les membres de leur famille aux remerciements qu'elles adressent et pour l'excursion à Tolède et pour les diverses réceptions au cours de la période du premier au douze septembre 1969.

The wives of the participants in the General Scientific Assemblies of the International Association of Seismology and Physics of the Earth's Interior and the International Association of Geomagnetism and Aeronomy are happy to express their gratitude to the ladies of the Spanish Committee for their daily attention and assistance, during the Madrid Congress.

They join with their husbands and families in giving thanks, and also express gratitude for the excursion to Toledo and for the various receptions during the Assemblies.

SCIENTIFIC RESOLUTIONS

1. The IAGA, recognizing the availability of many observatory results on microfilm, through the World Data Centers, nevertheless recommends the continued publication of magnetic observatory yearbooks containing hourly values and important related data, as described in a recommendation of the Rome IATME 1954 Meeting (IATME Bulletin No. 15, p.392).

1. L'AIGA, tout en reconnaissant qu'un, grand nombre de données d'observatoires sont tenues à disposition sur microfilms, par les Centres Mondiaux de Données, recommande néanmoins la continuation de la publication dans les Annales des Observatoires des valeurs horaires et des données importantes qui s'y rattachent ainsi qu'il a été précisé dans une recommandation du Congrès de Rome de l'AITME, en 1954. (Bulletin AITME No. 15, p.392).

2. The IAGA, considering that the indices D_{st}^e (equatorial ring current), AE (auroral electrojet) and K_n , K_s , K_m , (semi-planetary indices for N- and S- hemispheres and their mean value) have been determined for recent years and recognizing that they provide new condensed information on the state of disturbances of the geomagnetic field recommends the continued determination of these indices and urgently requests those observatories which are selected for this purpose to send their data promptly in order to make possible regular and early monthly publications.

2. L'AIGA considérant que les indices D_{st}^e (anneau équatorial), AE (électrojet auroral) et K_n , K_s , K_m , (indices semi-planétaires relatifs aux hémisphères Nord et Sud et leurs valeurs moyennes) ont été calculés pour ces dernières années et reconnaissant que ces indices constituent une source d'information synthétique nouvelle sur l'état de perturbation du champ géomagnétique recommande que l'on continue à déterminer ces indices et demande instamment aux observatoires qui ont été choisis à cette fin d'envoyer leurs données sans retard de façon à en permettre la publication mensuelle régulière la plus rapide.

3. The IAGA considering the planetary and other derived magnetic indices from individual stations, and that more and more such indices are now available compiled from the data of individual stations, recommends

- (i) The discontinuation of the publication of C-indices for individual stations in the Bulletin,
- (ii) The investigation of the possibility that K-indices be put in machine-readable form and stored at a center with facilities for the mechanical reproduction upon request,
- (iii) If (ii) is implemented then it is recommended that the discontinuation of the centralized publication of K-indices of individual stations be discontinued but that

their K-indices be published in their own yearbooks and bulletins.

3. L'AIGA, considérant que les indices magnétiques planétaires, ainsi que les autres indices magnétiques qui en dérivent, sont en général d'une importance plus grande, en ce qui concerne les études scientifiques, que les indices relatifs aux stations individuelles, et qu'un nombre croissant de ces indices ont été déterminés à l'heure actuelle à partir des données des stations individuelles,

recommande

- (i) d'arrêter la publication dans le Bulletin des indices C relatifs aux stations individuelles,
- (ii) d'étudier la possibilité d'une mise en forme des indices K se prêtant au calcul automatique, ces indices étant ainsi rassemblés en un centre convenable doté de moyens permettant leur duplication sur demande,
- (iii) si (ii) est mise en pratique, alors on recommande d'arrêter toute publication centralisée des indices K concernant les stations individuelles, tout en priant les observatoires de publier leurs propres indices dans leurs Annales et Bulletins.

4. The IAGA, noting recommendation No. 8 made by the South American Meeting on Geomagnetism in Rio de Janeiro in January 1969, concerning desirable development of the network of magnetic observatories in South America, gives its full support to the recommendation that magnetic observatories be established or completed in the Republics of Chile and Bolivia. This resolution also reinforces Resolution No. 12 of the International Union of Geodesy and Geophysics made at the 1967 General Assembly concerning the establishment of a permanent magnetic observatory on the mainland of Chile.

4. L'AIGA prenant en considération la recommandation No. 8 faite par le Congrès Sud-Américain de Géomagnétisme tenu à Rio de Janeiro en Janvier 1969, au sujet du développement désirable du réseau d'observatoires magnétiques d'Amérique du Sud, donne son appui total à la recommandation que des observatoires magnétiques soient établis ou renforcés dans leurs possibilités au Chili et en Bolivie. Cette résolution vient également à l'appui de la résolution No. 12 de l'UGGI adoptée lors de son Assemblée Générale de 1967, concernant l'établissement d'un observatoire magnétique permanent en territoire Chilien.

5. The IAGA, recognizing the scientific importance of the Moca Observatory located near the geomagnetic equator, requests the authorities responsible for the station to take appropriate measures to insure uninterrupted operation of the station at the present scientific level.

5. L'AIGA reconnaissant le rôle scientifique important assuré par l'observatoire de Moca situé au voisinage de l'équateur géomagnétique, demande aux autorités compétentes de bien vouloir prendre les mesures appropriées destinées à assurer la continuation de cette station ainsi que le maintien du niveau scientifique actuel.
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6. The IAGA recognizing the interest in completing the network of Southern observatories used for the determination of the K_s indices (see Resolution 2) recommends that a permanent magnetic observatory be established on Crozet Island by the responsible organization.
6. L'AIGA reconnaissant l'intérêt de compléter le réseau d'observatoires de l'hémisphère Sud servant à la détermination des indices K_s (cf. résolution 2) recommande qu'un observatoire magnétique permanent soit installé aux îles Crozet par l'organisation responsable.
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7. The IAGA considering the scientific value of the experiments conducted at the conjugate stations of Kerguelen and Sogra for the study of dynamics and the structure of the magnetosphere and the need to reach a more precise definition of the conjugacy, recommends that two additional pairs of conjugate station be put in operation at the following locations: Crozet and Pskov, Heard and Dologoschellie.
7. L'AIGA considérant l'intérêt scientifique des expériences entre les stations conjuguées de Kerguelen et de Sogra pour l'étude de la dynamique et de la structure de la magnétosphère, et la nécessité d'arriver à une définition plus précise de cette conjugaison, recommende que deux couples supplémentaires de stations conjuguées soient établies entre les points suivants: Crozet et Pskov d'une part, Heard et Dologoschelle d'autre part.
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8. The IAGA, considering the interest which represents the organization of multidisciplinary geophysical observations in conjugate points located in Australia and USSR, requests the appropriate Institution in these countries to take every possible measure to ensure this cooperation.
8. L'AIGA considérant l'intérêt attaché à l'organisation d'observations multidisciplinaires entre des points conjugués d'Australie et de l'URSS, demande aux Institutions compétentes de ces pays de prendre toute mesure possible de façon à assurer une telle coopération.
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9. The IAGA endorses the continuing conjugate point program concerning geomagnetic field phenomena at Great Whale River, and Byrd Station, and encourages the efforts to locate a geostationary satellite with a sensitive magnetometer near the field line connecting these stations.

9. L'AIGA donne son accord au programme continue en action entre les points conjugués de Great Whale River et Byrd Station concernant les phénomènes liés au champ géomagnétique et encourage les efforts destinés à placer un satellite géostationnaire, équipé d'un magnétomètre sensible, près des lignes de force reliant ces deux stations.

10. The IAGA, reemphasizes the importance of electromagnetic induction studies in the accessible East African Rift System and encourages organizations with the capability to undertake this work to do so in cooperation with interested African institutions. Both in this respect and for other reasons the continuation of the magnetic observations at Nairobi Observatory is highly desirable.

10. L'AIGA réaffirme l'importance de l'étude des phénomènes d'induction électromagnétique dans la partie accessible de la dorsale Est-Africaine et encourage les organismes ayant les moyens de s'attaquer à ce problème de le faire effectivement en coopération avec les Institutions Africaines intéressées. En fonction de ce qui précède, et également pour d'autres raisons la poursuite des observations magnétiques à l'observatoire de Nairobi est jugée très désirable.

11. The IAGA, emphasizes its scientific interest in magnetotelluric and geomagnetic depth sounding studies in West Africa and encourages such work in the sedimentary basin of Senegal.

11. L'AIGA tient à affirmer son intérêt scientifique pour les études par sondages profonds magnétotelluriques et géomagnétiques en Afrique Occidentale et encourage particulièrement ces études dans le bassin sédimentaire du Sénégal.

12. The IAGA recognizing the interest in magnetic profiles across the equatorial electrojet presently in progress or planned for the near future, recommends that, during the next solar minimum, those institutions interested in this work coordinate their efforts to make simultaneous profiles at various suitable longitudes.

12. L'AIGA, reconnaissant l'intérêt des profils magnétiques de part et d'autre de l'électrojet équatorial qui font l'objet d'opérations en cours ou sont prévues dans un proche avenir, recommande que, durant le prochain minimum d'activité solaire les organismes participants à ces opérations coordonnent leurs efforts en vue de réaliser des profils simultanés pour diverses longitudes bien choisies.

13. The IAGA considering the importance of obtaining a self consistent picture of distributions and variations of composition, density, temperature and winds in the upper atmosphere, and noting the recommendations of the 9th and 11th Working Groups of the IUCSTP concerning the study of the

structure of the upper atmosphere. (Arising from the conference on cooperative solar terrestrial physics for the International Years of the Active Sun, London, January 1969), recommends

- a) That in combination or as an alternative to drag measurements, accelerometer and density gage measurements be made on satellites with high eccentricity, to obtain density measurements with a single satellite over a large range of altitudes.
- b) That special efforts be made to obtain data for comparison of satellite measurements of diurnal density variation of ion temperature.
- c) Simultaneous measurements be made of composition by means of both mass spectrometers and monochrometers.
- d) (i) Measurements be made of composition, temperature and winds from 100 to 200 km in the winter polar region, where the sunlight has been cut off.
(ii) Wind profiles be measured above 200 km to establish global circulation patterns and to test the concept of excess rotation of the upper atmosphere.
- e) That more coordinated groundbased measurements of optical emissions from hydrogen and helium be made, and that high resolution studies of OI6300 Å for temperature and wind measurements be extended.
- f) Development of experiments for measurements of the eddy diffusion coefficient, especially in the height range 80 - 120 km.
- g) Extension of theoretical studies for construction of representative models describing composition, dynamics, the thermal regime and their interconnection.
- h) Extension of laboratory experiments for measuring rates of aeronomical reaction, including those determined by the minor components, and including those relevant to meteor processes, particularly atomic collision phenomena in the energy range 100 - 1000 eV
- i) (i) That although there has recently been an increase in the network of meteor stations, there should be an extension of the network in high latitudes.
(ii) That when possible the meteor-wind stations be associated with existing rocket launching sites.
- j) That since there exist uncertainties in the interpretation of ionospheric drift measurements, and a means of calibration would in many cases enable these observations to become a useful source of wind information, radio meteor winds should be used to provide a comparison for this purpose, particularly with ionospheric-drift techniques that extend to lower heights and overlap the meteor region.

13. L'AIGA considérant l'importance qu'il y a d'arriver à une représentation d'ensemble cohérente de la répartition et des variations de la composition de la densité, de la température et des vents dans la haute atmosphère et prenant note des recommandations des groupes du travail 9 et 11 de l'IUCSTP relatifs à l'étude de la structure de la haute atmosphère, (Issues de la Conférence sur la coopération du physique des relations Soleil-Terre pour les Années Internationales du Soleil Actif-Londres, Janvier 1969), recommande

- a) que, simultanément ou en remplacement des mesures d'amortissement, des mesures d'accélération et de densités par prélèvement soient faites par les satellites ayant des orbites très excentriques et ceci dans une large marge d'altitudes.
- b) que des efforts particuliers soient faits pour l'obtention de données permettant la comparaison des mesures faites en satellite relatives à la variation diurne de la densité, avec les mesures de diffusion Thompson, de la variation diurne de la température ionique,
- c) que des mesures simultanées de composition soient faites au moyen de spectromètres et de monochromètres.
- d) (i) que des mesures soient faites de la composition, de la température et des vents entre 100 et 200 km. d'altitude, en saison hivernale des régions polaires où la lumière solaire a disparu,
(ii) que des mesures de répartition des vents soient faites suivant des profils d'altitudes supérieures à 200 km. afin d'établir les schémas de circulation générale et de vérifier la validité de l'idée d'un excès de rotation de la haute atmosphère.
- e) que des mesures au sol mieux coordonnées soient faites sur les émissions lumineuses de l'hydrogène et de l'hélium et que des études d'un grand pouvoir de résolution de 0.16300 Å relatives aux mesures de température et de vents soient généralisées,
- f) que l'on développe les expériences axées sur la mesure des coefficients de diffusion incohérente, tout spécialement dans la zone 80 à 120 km. d'altitude.
- g) que l'on développe les études théoriques en vue de la réalisation de modèles représentant la composition, la dynamique des régimes thermique et leur interconnexion.
- h) que l'on développe les expériences de laboratoire pour la mesure des vitesses de réaction aéronomiques, y compris celles dépendant de composants mineurs et celles dépendant des traînées de météorites, et tout particulièrement les expériences relatives aux chocs entre atomes dans la gamme d'énergie 100 - 1000 eV.

- i) (i) que, bien qu'il y ait eu récemment une extension des réseaux de stations d'observation des météores, cette extension devrait être poursuivie pour les réseaux des hautes latitudes.
- (ii) que, chaque fois que cela est possible, des stations d'observation de vents de météores, soient associées aux sites existants de lancement de fusées.
- j) que, étant donné les incertitudes qui se manifestent dans l'interprétation des mesures sur les dérives ionosphériques et remarquant que des étalonnages convenables permettraient dans beaucoup de cas de valoriser ces mesures pour la connaissance des vents, on devrait utiliser les vents de radio-météores en tant que moyens de comparaison permettant ces étalonnages particulièrement en utilisant les techniques de dérive ionosphérique qui s'étendent aux basses altitudes et recouvrent la région des météores.

14. The IAGA considering the importance for space studies to have systematized information on micropulsations occurring on a worldwide scale, urges the national research groups working on micropulsations to work out planetary indices based on the different existing types of micropulsations.

14. L'AIGA considérant l'importance pour les études spatiales de disposer d'informations systématiques sur les micropulsations se produisant à une échelle mondiale demande instamment aux groupes de recherche des divers pays travaillant sur les micropulsations, d'élaborer des indices planétaires à partir des différents types connus de micropulsations.

15. The IAGA, considering that the World Data Centers for Geomagnetism have the necessary magnetic observatory data in their archives, and considering the scientific need for the magnetic activity indices AE and Dst, urges the World Data Centers for Geomagnetism to undertake the computation of these indices.

15. L'AIGA considérant que les Centres Mondiaux de Données pour le géomagnétisme disposent dans leurs Archives, des données requises d'observatoires et considérant la nécessité scientifique d'une connaissance des indices d'activité magnétique AE et Dst, demande instamment aux Centres Mondiaux de Données pour le Géomagnétisme d'entreprendre la détermination de ces indices.

16. The IAGA, noting the importance of mapping the plasma-pause on a continuous worldwide basis, and noting that achievement of such mapping will require basic research, technical development, and a high level of international cooperation,

encourage its member countries to support cooperative studies of the problem of worldwide plasmopause monitoring.

16. L'AIGA relevant l'importance d'une cartographie de la plasmopause à assurer d'une façon continue à l'échelle mondiale, et remarquant que la réalisation d'une telle cartographie nécessitera certaines recherches fondamentales, des progrès techniques, et un degré élevé de coopération internationale, encourage ses états membres à donner leur appui à des études coopératives du problème de l'exploration de la plasmopause à l'échelle mondiale.
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17. The IAGA, considering the value of satellite data that are of a routine monitoring nature, such as measurements of solar wind parameters, magnetospheric boundary crossings, local time variations of the magnetic field at the synchronous orbit, etc., for a synoptic patrol of the magnetosphere and the establishment of new indices, recommends that countries, institutions and scientists operating such satellites, in conjunction with the World Data Centers, establish a mechanism for the quick release of these routine data and their distribution in convenient format to the scientific community.

17. L'AIGA considérant la valeur des données fournies par les satellites suivant une base régulière telles que les mesures concernant les paramètres caractéristiques du vent solaire, les traversées des frontières magnétosphériques, les variations en fonction du temps local, du champ magnétique sur les orbites synchrones, etc, ceci dans le but d'une surveillance synoptique de la magnétosphère et l'établissement de nouveaux indices, recommande, que les états, institutions et personnalités scientifiques, responsables de l'emploi de ces moyens, mettent en oeuvre, en accord avec les Centres Mondiaux de Données, une logistique assurant une mise à la disposition rapide de ces données régulières et leur distribution sous une forme convenable à la communauté scientifique.
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III SELECTED ITEMS OF INTEREST

THE WORLD MAGNETIC ARCHIVE. Some notes on its purpose and progress by Sydney Chapman

Development of the WMA Proposal

Since October 1967 I have been trying to have made available in machine readable form the hourly values of the magnetic elements from the great store of reliable geomagnetic records accumulated since about 1850--over a century now. I gave to this project the name World Magnetic Archive (WMA), and proposed also as a secondary part of it the reproduction on microfilm of the magnetograms from which the hourly records were taken.

In October 1968 the WMA project was endorsed by the Executive Committee of the International Association for Geomagnetism and Aeronomy, which referred it for consideration of detailed plans to its Commissions I and II, whose Chairmen are respectively Prof. A. P. De Vuyst and Mr. B. R. Leaton. Dr. Leroy R. Alldredge, IAGA General Secretary, in IAGA News No. 7 (July 1968), has described the steps leading to this action. Prof. De Vuyst, in a letter to Mr. Leaton, of November 1968, has made excellent proposals for initial joint action by these Commissions, and the plans are to be further developed at a joint meeting of the two Commissions at Madrid, September 1969.

Support by the ICSU Inter-Union Commission on Solar-Terrestrial Physics (STP Notes No. 4, May 1969, p. 20).

In the course of its deliberations at its first general conference in London, England, 27-31 January 1969, which concerned a great range of recent studies by many techniques of geophysical and space science, the Commission also considered the only partly exploited value of the older geophysical data, particularly geomagnetic data, and made recommendations as follows:

The Conference

Recommends the study of older geophysical data for the improvement of our knowledge of the correlations between geomagnetic and meteorological data that may be influenced by the changes in the intrinsic state of the Sun as shown by sunspots and other solar data.

In particular, it

Recommends that the availability of daily indices of the geomagnetic state of the Earth be extended backwards from the beginning of the presently available series. For this purpose the execution of the

project of the World Magnetic Archive, sponsored by IAGA, will be of great value.

The Conference

Requests IAGA at its forthcoming Madrid meeting to consider and organize such studies of older data.

The IUCSTP Bureau

Has noted and endorsed the foregoing recommendation.

The desirability of extending backwards the series of daily magnetic character figures C from the date (1890) when these began was stressed, at the conference, by Dr. E. Mustel, who reported there his studies of geomagnetic and meteorological correlations partly based on the series of C numbers since 1890.

This work would involve reference to the magnetograms of at least a selection of the observatories whose records were begun before 1890.

The order and manner in which the hourly data should be made available.

The hourly values of the magnetic declination are unaffected by the temperature of the magnetograph, and where they are available, published or unpublished, they present the fewest problems in being made available in machine-readable form or this reason perhaps they should be the first to be made available. The hourly values of horizontal and vertical force are affected by temperature changes, and consideration is required as to their correction--whether this should be done for each hourly value, or only for the monthly mean hourly values.

Some worthwhile studies proposed on the basis of the older geomagnetic data.

The influence of the sunspot cycle on the transient magnetic variations, both magnetic disturbance and the solar and lunar daily variations: For these purposes the longest series are, of course, the most valuable.

Magnetic disturbances, especially magnetic storms It may be desirable to extend backwards before 1932/3 the series of K and Kp indices, and it may be possible to determine Dst over a period of many years, for correlation with solar data of the same or earlier date.

The solar daily magnetic variation; its seasonal and day-to-day changes, and (from the longer series of data) its secular change can be determined.

The lunar daily magnetic variation, especially for the main lunar and lunisolar harmonic components that depend on the main term M_2 in the lunar tidal potential; From the longer series of data the harmonic lunar and lunisolar components depending on smaller (but still major) terms in the lunar tidal potential may be determined, e.g., for O_1 and N_2 . Such studies are valuable in connection with the large-scale dynamics of the atmosphere.

Shorter series of data may be found useful in studying the nonionospheric part of the magnetic variations, concerned with electromagnetic induction and dynamo effects in the oceans.

It may prove useful to apply power spectrum analysis to many series of past magnetic data, both short and long.

Summary of the responses so far made by different authorities to proposals for cooperation in the WMA project

Only a few countries that have operated magnetic observatories for several years have as yet put the hourly values from all their past records on cards or tape, though some are doing so far their current records, e.g., Australia, Belgium, Canada, Finland, United Kingdom and United States, and doubtless other countries unknown to me. Finland is one country (perhaps the only one) whose hourly magnetic data are available on tape from their inception, namely for Sodankylä (since 1902) and Nurmijärvi (since 1937). These long series have been made available to me by the courtesy of Mr. C. Sucksdorff, and the solar and lunar daily variations from the long series of Sodankylä records have already been studied, in conjunction with Dr. J. C. Gupta.

Under Dr. Gupta's supervision almost all the available hourly values obtained during the IGY/C have been put on tape, and from them the solar and lunar daily variations for a hundred observatories have been determined, under the auspices of the National Center for Atmospheric Research, Boulder, Colorado, with the support of the National Science Foundation of the United States.

Among the authorities I have approached in regard to the WMA, the following have responded favorably.

Australia. All the hourly data for Watheroo is on tape, for the period 1919-1958 during which the observatory was in operation. It was transferred to another site in 1958. Active progress is being made in the transfer of other past Australian magnetic data to tape.

Canada. The transfer to tape of the past magnetic data is in active progress.

Denmark. Dr. Andersen has intimated that the Danish Meteorological Institute will take part in the WMA project.

East Germany. Dr. Fanslau supports the WMA project, and is preparing the long series of Potsdam-Sessin-Niemegk data in a form suitable for the WMA.

India. I understand from Dr. Bhargava, Director of the Colaba (Bombay) and associated observatories, that plans are made for putting the outstandingly long series of Bombay magnetic hourly data on cards.

Netherlands. Dr. Veldkamp reports that the Witteveen data from 1954 are already on cards, and that the Witteveen magnetograms are reproduced on microfilm since 1957. He indicates his hope that the older Netherlands magnetic data may be included in the WMA.

United Kingdom. The Abinger data from 1926 are being put on cards, using prison labor without charge (see Appendix I).

U.S.S.R. Dr. Pushkov informed me at the STP conference in London, in January 1969, that the WMA project is in operation for certain of the older Russian data.

The format and location of the WMA.

Important matters to be considered by Commissions I and II are the formats of the WMA data (for card and for tape--magnetic or paper), and the Centers at which the data should be collected. The IGY World Data Centers for the collection, storage and distribution of the IGY data have proved very valuable. For the WMA the Centers should fulfill certain requirements perhaps not met by all the IGY-WDCs; this is because strict uniformity in the nature and format of the data supplied is perhaps more than can be expected or required, and these (World Digital Data)Centers should have comprehensive computer resources to enable conversion from one format to another, to meet the needs of different users. Of the existing IGY-WDCs, only Washington and Tokyo seem to have the full facilities suitable for a WDDC. There is also a WDDC at Herstmonceux (U.K.), and a possibility of one being set up in India.

As regards formats, see item on Digital Magnetic Data. Other WMA items are the IAGA Resolutions Nos. 4, 8, 14 (re WDDCs) and 24, passed at the St. Gall 1967 meeting (IAGA Bulletin No. 24).

Appendix I

World Magnetic Archive, (by S. R. C. Malin)

Progress in United Kingdom (at Herstmonceux).

Following the suggestion of Professor Chapman, the United Kingdom Prison Commissioners were approached and asked if they would permit prisoners to punch cards for the WMA. They readily agreed, and suggested that the work should be done at an open prison, near Arundel. They agreed that no charge would be made for the prison labor. After discussion with the governor of the prison, three hand-punches were ordered (price \$190.00 each) and a simple description was written of the project, and of the use and maintenance of the punches and cards, for the guidance of the prisoners.

The equipment was delivered to the prison, and 4 hours were spent with the four prisoners assigned to the job, explaining the purpose of the work, and training them in the use of the punches. It was emphasized that accuracy was more important than speed. Subsequently minor problems were resolved by telephone conversation.

The data being punched are the hourly mean values of D, H and Z observed at Abinger from 1926, as published in tabular form in yearbooks (although the bi-hourly values are already available in machine readable form). The format for the cards is that described by Malin (IAGA News No. 7). The data are punched on colored cards (blue = Z, yellow = D, green = H) and also on white cards, for comparison. The individual prisoners are identified by initials, and care is taken that the duplicate cards are not punched by the man who punched the initial cards. When about 5000 cards have been punched, they are posted to Herstmonceux, where the duplicate cards are machine-compared with the originals; corrections are made (usually very few), and the duplicate cards are discarded. The data are then written onto magnetic tape.

The prisoners are very happy with the work (they call themselves the "Computing Division!"); it is of a much less boring nature than most of the prison jobs (e.g., scraping plastic mouldings).

As well as the prison work, mean hourly values from Hartland, Eskdalemuir and Lerwich are converted to machine readable form at Herstmonceux on a current basis, and the punching of Hartland data to date from 1957.0 (when it started operating) is almost complete.

SURVEY OF ARCHIVE DATA

At the Madrid Assembly, Working Group II₆ on Data Interchange, decided to obtain an inventory of data available for the World Magnetic Archive (WMA), by circulating the letter copied below to the IUGG National Representatives. If any reader has information to report on the questionnaire, please furnish this information to your IUGG National Representative and send a copy to Professor M. Ota (his address is on the questionnaire).

IUGG National Representative

Dear _____:

It has been decided that the World Magnetic Archive proposed by Prof. S. Chapman, and endorsed by the IAGA Executive Committee, will initially be restricted to magnetic observatory data (hourly means, eye readings, and magnetograms). Data from the earliest records to the present from both permanent and temporary stations will be included.

The first step is to determine what data is available and in what form.

It has been decided to obtain this information by asking an official from each country to compile answers to the enclosed questionnaire after soliciting information from all appropriate agencies within his country. The data reported should generally include only data obtained from stations operated by your country since all countries are being asked to do the same thing.

Please return the enclosed questionnaire to Professor M. Ota, WDC-C2 for Geomagnetism, Kyoto University Library, Post No. 606, Kyoto, Japan, as soon as possible but not later than 1 April 1970.

Sincerely yours,

Leroy R. Alldredge
General Secretary, IAGA

World Magnetic Archive Questionnaire
(Attachment to letter on previous page)

It is requested that the official (IUGG Representative) of each country prepare a consolidated report for his country and send it to Prof. M. Ota, WDC-C2 for Geomagnetism, Kyoto University Library, Post No. 606, Kyoto, Japan, no later than 1 April 1970.

A. Geomagnetic Hourly Values (including eye readings)

1. What data exist in the libraries and archives of your country?
2. What part of these data are in machine readable form, either in your country or in the World Data Centers?
3. What specific plans exist for converting the remainder of the data (time schedule) to machine readable form?
4. If unable to convert data to machine readable form, can copies of data be supplied to others? (Refer to IAGA News No. 8 for desired format.)

B. Magnetograms

1. What magnetograms exist in the libraries and archives of your country?
2. What part of these magnetograms are on microfilm?
3. What specific plans exist for microfilming the remainder?
4. If unable to microfilm the magnetograms can they be loaned to others?

C. Additional Information

Please add additional comments regarding data which you have but which may not be readily available to others even if data were taken by observatories of another country. Also, please give any information on your country's data which you believe exists only elsewhere, or which you know to have been destroyed.

DIGITAL MAGNETIC DATA

At the Madrid Scientific Assembly of IAGA, Commission I and II agreed on the following formats which should apply to other data exchanges as well as to the World Magnetic Archive (W M A)

Adopted Format for Punched Cards and Punched Paper Tape

Card Format : Hourly Values.

Card 1

Column

1-6	Observatory Code ⁽¹⁾
7	Element ⁽²⁾
8-11	Year ⁽³⁾
12-13	Month
14-15	Day
16	I
17-20	Tabulator Base ⁽⁴⁾
21-68	12 hourly values, ⁽⁵⁾ (0 ^h -12 ^h U.T.)
69-79	Blank ⁽⁶⁾
80	I

Card 2

1-16	as card 1
17-20	Blank
21-68	12 hourly values ⁽⁵⁾ (12 ^h -24 ^h U.T.)
69-72	Mean of the 24 hourly values (where available)
73-77	Sum " " " " " " "
78-79	Blank ⁽⁶⁾
80	2

Paper Tape Format : Hourly values

Position

1-6	Observatory Code ⁽¹⁾	
7	Element	
8-11	Year ⁽³⁾	
12-13	Month	} or {
14-15	Day ⁽⁷⁾	
16	1	
		{ 13-15 Day number ⁽⁷⁾ 1-365 or 366
		{ 16 2

End of line character

17-20	Tabular Base ⁽⁴⁾
21-116	24 hourly values
117-120	Mean of the 24 hourly values (where available)
121-125	Sum of the 24 hourly values (where available)

End of line character

Repeat from 17-125 for a complete element-month.

When sending data to a W.D.D.C., it is important that the cards or tape be accompanied by a full description of their content (including the procedure used for checking the accuracy of the punching) and a listing of at least the first part of the data.

-
- (1) Alphabetic mnemonic (columns 1-3) or Numbercode (1-6) from IAGA Bulletin No.20.
 - (2) D = 1, F = 2, H = 3, I = 4, X = 5, Y = 6, Z = 7.
 - (3) If desired, the first digit may be omitted.
 - (4) Tabular base in degrees for D or I and hundreds of gammas for the intensity elements. The bases are right justified and signed, if negative. Negative values are identified with a minus sign either adjacent to the first significant digit or in the high-order position of the field.
 - (5) A missing value is punched 9999

- (6) These columns may be used for (eg.) temperature coefficient.....
- (7) Day¹ or Day number¹ on paper tape refers to the first day for which data are punched; for a full month it will be 01. If days are missing, a new tape may be commenced, starting with the first day after the gap.

Recommened Magnetic Tape Format for Hourly and 2.5 minute Values

Position

1-3	Observatory Mnemonic Code, left adjusted.
4-5	Year, last two digits
6-7	Month (01-12)
8	Element (same code as for cards and paper tape)
9-10	Day (01-31)
11-12	Blanks
13-15	Arbitrary.
16	Blank for data since 1900, '8' for data prior to 1900.
17-20	Tabular base, in degrees for D and I, hundreds of gammas for the intensity elements. The bases are right adjusted and signed if negative. Negative values are identified with a minus sign either adjacent to the first significant digit or in the high-order position of the field (position 17)
	NOTE: A blank digit will not appear between a minus sign and the first significant digit. For example, a base may appear as -050 or b-50 but not as -b50 (b=blank).
21-116	Twenty-four 4-digit Hourly Values for the day. The values are in tenth-minutes for D and in gammas for the intensity elements. The first hourly value represents the mean value between 00h and 01h.....the 24th value represents the mean value between 23h and 24h. Rules for negative values are the same as those described for tabular bases. A missing value is identified by a 9999.

117-120

Daily Mean. Rules for negative values are the same as those described for tabular bases. If any of the hourly values for the day are missing, a 9999 will appear as the mean.

The 26 values in positions 21-120 will have the range -999 to 9998, with 9999 reserved for missing values. To avoid a 4-digit negative value in positions 21-116, the tabular base will be adjusted for that day for example for D, one degree is subtracted from the base and 600 units are added to each of the hourly values for the day---- for the intensity elements, 500 gammas are subtracted from the base and 500 gammas are added to each of the hourly values for the day.

Each tape block contains 20 records (2400 characters). A standard inter-record gap appears between tape blocks. When necessary, padded nines are used to complete the last block of data. Two or more tape marks follow the last block of data.

The records are sorted according to observatory mnemonic, year, month, element, day (positions 1-10).

NOTE: the same format is used for 2.5-minute values, except positions 11-12 contain the hour (00-23); and the first data value is for 2.5 minutes past the hour. For 2.5 minutes values the hourly mean appears in positions 117-120, if more than 20 2.5 minutes values are missing the mean will appear as "9999".

NOTE: For those unable to use alphabetic identifications or month-day notation, the following is suggested:

- a) observatory code... use a 2 or 3 digit code.
- b) element... use by 1=D, 2=F, 3=H, 4=I, 5=X, 6=Y, 7=Z.
- c) month-day... leave positions 6-7 and 9-10 blank and place day number in positions 13-15.

Sample Computations Showing Use Of Tabular Bases

	D	H	Z	X	Y
Tabular Base	-006	155	-485	-025	090
Hourly value	<u>-623</u>	<u>-032</u>	<u>-096</u>	<u>26</u>	<u>250</u>
Total value	-7 ⁰ 02.3'	15468	-48596	-2474	9250

As shown above, the value of a magnetic element at any particular time is obtained by adding the signed tabular base to the signed value.

The customary geomagnetic convention is followed: all magnetic values are referred to the north-seeking end of the

compass needle, with X regarded as positive when directed northward, Y as positive when directed eastward, Z as positive when directed downward, and D as positive when directed eastward.

Where data are digitized in a semi-automatic manner from normal magnetograms, only one sample should be taken each 2.5 minutes.

When the basic data are obtained from an automatic digital instrument with a very rapid sampling rate it is recommended that only an sample per minute be preserved for the World Digital Data Centers.

GEOMAGNETIC ANOMALIES

The following letter has been sent by Dr. Hahn, the Reporter of the W.G. on Geomagnetic Anomalies IAGA Commission III, to all the national committees. Those who are interested in the subject are requested to get in touch with Dr. Hahn.

Subj.: Semiquantitative Interpretation of Local Anomalies Measured in total field profiles of "Project Magnet".

At the meeting held in Pittsburgh, fall 1964 the World Magnetic Survey Board asked the Working Group to consider the possibility of establishing a world chart which shows the character of local anomalies as measured by single profiles in such a way that some information about the distribution of the respective geological magnetic bodies might be derived from this chart.

The profiles measured by the "Project Magnet" which has been carried out by the US Naval Oceanographic Office have been considered as the best data to start with since they cover great parts of the world and are measured homogeneously.

Since then a method has been worked out how to process the given data for this purpose. It comprises the following steps:

- 1) The local anomalies are separated from the large-scale anomalies by a suitable filter.
- 2) Intervals of similar character are cut out of the profiles (length of these intervals: about 300 - 600 km).
- 3) A FOURIER analysis is carried out for each interval.
- 4) From the resulting spectrum parameters for the depth and for the inhomogeneity of the magnetic mass (which in most cases can be considered to be proportional to the mass itself) are estimated and plotted on the chart.

However, to process in this way all the data provided by "Project Magnet" implies 3 years of work for a scientist plus 8 years of a technician, which obviously cannot be accomplished by one institute within a reasonable time.

Therefore institutes which are interested in a semiquantitative interpretation of total field profiles in any part of the world covered by the "Project Magnet" are invited to participate in this work. Any institute may select its areas

of interest and is requested to process data only for these areas in the way described above so that the parts can afterwards be combined to one chart.

Institutes which intend to participate are requested to contact

Professor Albrecht Hahn
Bundesanstalt fuer Bodenforschung
Postfach 54
3 Hannover-Buchholz
Fed. Rep. of Germany

who will supply the participants with detailed information necessary to the investigation.

DATA EXCHANGE BETWEEN MARINE GROUPS

In February 1969 Dr. D. H. Matthews indicated to Mr. B. R. Leaton that following the adoption of the International Geomagnetic Reference Field (IGRF) the next need is for an efficient method of data exchange between marine groups. To help with this he sent along an account of a meeting held at Scripps Institution of Oceanography which should be of interest to many IAGA scientists. A copy of his report is given below.

Oceanographic research vessels have been gathering continuous records of total field with towed proton precession magnetometers since 1956. The institutions operating these vessels have been relatively slow to develop a system for exchanging these data among themselves. The need for such a system was emphasized at the IAGA/WMS meeting held in Washington October 1968, where it appeared that, so far as the ocean areas were concerned, the only independent data set against which the spherical harmonic expressions for the earth field derived from satellite observations had been tested was a tape file of the sea observations compiled by ESSA Coast & Geodetic Survey. This file contained only a few percent of the available non-classified data.

On the 13th and 14th January 1969, a symposium was held at Scripps Institution of Oceanography on Applications of Sea-Going Computers. The day following this meeting a smaller meeting was convened by Dr. J. G. Sclater to discuss the means of exchanging computer readable data (i.e., navigation, magnetic, gravity, underway temperature profiles, etc.) between the principal marine geological laboratories. Twelve institutions were represented. Although no resolutions were passed the following is my personal account of the sense of the meeting.

Most groups have punched cards as their basic storage medium for corrected data, although they transfer the data to disk or tape for plotting or other calculations. Although there was agreement that the easiest way to send a large amount of data through the post was as card images on magnetic tape, it was clear that in practice there is difficulty reading a tape recorded in one laboratory even on apparently compatible machines in another laboratory. Two systems are in use for storage of corrected data. Dr. Talwani (Lamont Geological Observatory, the largest single collector of marine geophysical data) would wish to exchange a time series of navigation points (i.e., the time and date, latitude and longitude of all points at which the ship's velocity changed by an appreciable amount) and a separate time series of the observations (e.g., time and date and magnetic field reading). Dr. Bowin (Woods Hole Oceanographic Institution) would wish to exchange a single merged series (i.e., time and date, distance along the track, latitude and

longitude and magnetic field reading). The systems in use by other groups fall into one or other of these general classes. Advantages claimed for Dr. Talwani's system were better compression of the data (storage of cards is becoming a problem), ease of hand plotting by groups not wishing to use a computer, and easy linear interpolation of the IGRF which need only be computed at the navigation points. Disadvantages are that the computer must do more work before each point can be plotted and that it is relatively hard to select all the information within a given area from the file of data. There was no unanimous conclusion to the discussion; clearly the two main groups utilizing merged data, Woods Hole Oceanographic Institution and Bedford Institute of Oceanography, intend to go on doing so, but Scripps Institution and most of the others will use some form of the Lamont system for data exchange. It was agreed that it should be the responsibility of the recipient of data to convert from the donor's format into his own. Clearly data in the merged WHOI system can be converted into the separate time series of the Lamont system at the expense of a certain programming effort, but it was generally agreed that the conversion would be easier if the merged data were accompanied by a separate listing of navigation points.

ENGLISH TITLE OF URSI

1. As from 1 January 1969, the English title of URSI will be

International Union of Radio Science

It is emphasized that there will be no change in the French title which is

Union Radio-Scientifique Internationale

Moreover, the well-known initials "URSI" will continue to be used in English as well as in French.

2. The decision to change the English title has been made after consultation with the National Committees for URSI and with the approval of the Board of Officers. The old English title was adopted in 1927 and owing to changes in English usage during the past 41 years, it is no longer appropriate. The adoption of the new title does not imply any change in the objectives of the Union.

SOUTH AMERICAN MEETING ON GEOMAGNETISM

Report by Dr. Lelio I. Gama - Convenor

The South American Meeting on Geomagnetism, 1969, was promoted under the auspices of the International Association of Geomagnetism and Aeronomy (IAGA), and took place in Rio de Janeiro, at the National Observatory of Brazil, between the 6th and 11th January, 1969.

Attendance:	Argentina	Roberto Hernandez
	Bolivia	Salvador del Pozo
	Brazil	Lelio I. Gama (Chairman)
	Chile	John Bannister
	Colomiba	Clemente Garavito
	Peru	Mateo Casaverde

Recommendations

Upon discussion of the Agenda submitted by Prof. Gama the following Recommendations were approved.

1. Standardization Center

In compliance with the Recommendation contained in Resolution No. 1 of the IAGA Meeting at St. Gall, 1967; and considering facilities at present available at the Pilar Geophysical Observatory, Argentina, it is resolved to confirm Resolution No. 9 of the Buenos Aires Meeting of the Pan-American Institute for Geography and History, 1961, to the effect that the Pilar Observatory be designated for the standardization of observatory magnetometers in South America.

2. Publication of Magnetic Charts

It is agreed that magnetic charts for South American countries should involve the elements I, D, H, F and their isopors. The epochs should be the beginning of each year ending the "0" or "5". (1965.0, 1970.0, 1975.0, ...).

The scale should be between 1:5 million and 1:10 million, according to regional convenience.

It is recommended that isolines be spaced as follows: isoclinic lines at 2-degree intervals between even degrees; isogones at 1-degree intervals; isodynamic lines (H and F) at 250-gamma intervals beginning at whole hundreds (as 28500, 28750, 29000, ...).

3. Corrections

Corrections to survey measurements to provide data for constructing magnetic charts should include:

(a) Correction for diurnal variation.

For stations not below the equatorial electrojet the observed values of the horizontal component (H) and of the declination (D) should be corrected to the midnight values according to the records of the nearest magnetic observatory if within a distance of 500 km from the station; or, in the case of larger distances, by interpolative procedure between the two nearest observatories. For stations below the electrojet correction of observed values of H and D to midnight values should be determined from the records of the permanent observatory at Huancayo, Peru, by using reduction coefficients appropriate to magnetic latitudes between $\pm 8^\circ$. Future permanent stations in the vicinity of the dip equator in South America should contribute to furnish similar corrections.

Reduction from observed values of the inclination (I) to the midnight values should be made through the records of the nearest magnetic observatory or, as the case may be, by interpolation between the two nearest observatories.

(b) Reduction from the midnight value to the annual mean value of the element for the calendar year of observation. This correction is intended to eliminate the variation of Sq with season as well as the effect on survey values of variations due to magnetic disturbance.

The correction should be obtained from the records of the nearest magnetic observatory if less than 500 km distant from the station, or, in the case of larger distances, by interpolation between the two nearest permanent stations.

(c) The annual mean value of an element for the calendar year of observation (as obtained under (b) above) should be corrected to the annual mean value for the year centered at the time of observation. To do this a provisional estimate of the secular change at the station may be used.

(d) Solar cycle correction.

The solar cycle effect, as here considered, is the deviation of the annual mean value of an element (H, D, I) from its secular value as determined by running averages for 11 years. To obtain the corresponding correction reference should be made to the records of long-established observatories in South America. Provisionally it is recommended to use data from

Huancayo for field stations in Peru, Bolivia, the southern part of Colombia and the western border of Brazil; data from Pilar for stations in Argentina, Chile, the southern part of Bolivia and southwestern border of Brazil; data from Vassouras for stations in Brazil.

- (e) Reduction of survey values to the epoch of the chart.
It is recommended that this correction be obtained by least-squares fitting of a straight line or 2nd-degree parabola to recent survey measurements made at the station during some five years prior to, or containing, the epoch of the chart.

4. Data Exchange

It is recommended as a highly convenient routine that survey observations taken in frontier territories should be exchanged between chart-producing agencies of adjoining countries. It is also deemed convenient for countries with common boundaries to coordinate their survey activities in confining areas whenever feasible.

5. Elaboration of magnetic charts

It is recommended that a uniform procedure for the computation of magnetic charts be adopted on the basis of least-squares fitting - to corrected observational data - of quadratic polynomials of the form

$$f = f_0 + A\Delta\varphi + B\Delta\lambda + C\Delta\varphi^2 + D\Delta\varphi\Delta\lambda + E\Delta\lambda^2$$

for $f = D, I, H, F$

where $\Delta\varphi = \varphi - \varphi_0$, $\Delta\lambda = \lambda - \lambda_0$.

φ_0 and λ_0 are the latitude and longitude of a conveniently chosen reference station of the surveyed area. A, B, C, D, E are parameters to be determined by least squares.

6. Manual for the preparation of magnetic charts

It is recommended that a manual dealing with details on the correction and reduction of observational field data for the preparation of magnetic charts should be made available in the Spanish language.

7. Permanent coordination

In order to ensure continuance in the work initiated in this Meeting it is unanimously agreed to place in the hands of Prof. Lelio J. Gama the permanent coordination of our activities and the care of watching over the fulfillment of Recommendations.

8. Magnetic observatories

As a most important requirement for the integration of the South American system of magnetic observatories, it is highly convenient and urgently recommendable that magnetic observatories be established, or completed, in the Republics of Chile and Bolivia.

9. Airborne surveys

Airborne magnetometer surveys with support on ground observatories should be encouraged.

ADDRESSES OF ORGANIZATIONS OPERATING MAGNETIC
OBSERVATORIES (Names of dependent observatories are
shown in parentheses beneath the address)

This list of current observatories was compiled by Mr. Kendall
L. Svendsen, of ESSA, Coast and Geodetic Survey, May 15, 1969.

- | | |
|---|---|
| Institut de Météorologie et de
Physique du Globe de Algérie
Université d'Alger
B. P. 1137
Algiers, Algeria
(Tamanrasset) | Centre de Physique du Globe
Dourbes (Nismes)
Prov. de Namur, Belgium
(Dourbes) |
| Centro de Geofísica de Luanda
Serviço Meteorológico de Angola
Caixa Postal 1228
Luanda, Angola
(Luanda) | Observatoire Magnétique de Manhay
Université de Liege
Manhay (Prov. Lux.), Belgium
(Manhay) |
| Instituto de Geofísica
Servicio Meteorológico Nacional
Av. de los Constituyentes 3454
Buenos Aires, Argentina
(La Quiaca, Orcadas del Sur,
Pilar) | Instituto Geofísico Boliviano
Casilla 401
La Paz, Bolivia
(La Paz, Santa Cruz) |
| Observatorio Astronomico
Universidad Nacional de La
Plata
Paseo del Basque
La Plata, Argentina
(Las Acacias, Trelew) | Observatório Nacional
Ministério da Educação e Cultura
R. General Bruce, 586
São Cristovão
Rio de Janeiro, Brazil
(Tatuoca, Vassouras) |
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Bureau of Mineral Resources
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Canberra City, ACT, Australia
(Gnangara, Macquarie Island,
Mawson, Port Moresby,
Toolangi) | Geophysical Institute
Bulgarian Academy of Sciences
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(Panagyurishte) |
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Hohe Warte 38
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Dominion Observatory
Department of Energy, Mines and
Resources
Ottawa 3, Ontario, Canada
(Agincourt, Alert, Baker Lake,
Churchill, Great Whale River,
Meanook, Mould Bay, Ottawa,
Resolute Bay, Victoria) |

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Section Géophysique
Direction de la Météorologie
Ministère des Transports et
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Departamento de Geofísica
Academia de Ciencias
Capitolio Nacional
Havana, Cuba
(Centro Geofísico)

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Slovak Academy of Sciences
Hurbanovo, okr. Komárno
Czechoslovakia
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Československá Akademie Věd
Geofyzikální Ústav
Boční II, čp. 1401
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(Budkov, Průhonice)

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Charlottenlund, Denmark
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schaften zu Berlin
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Colaba and Alibag Observatories
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Geodetic and Research Branch
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South Pole, Tucson)

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830 South Oval, Room 107
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Norman, Oklahoma 73069
U.S.A.
(Tulsa)

Weston Observatory
Weston, Massachusetts 02193
U.S.A.
(Weston)

IZMIRAN
p/o Akademgorodok
Moscow region, USSR
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Caracas, Venezuela
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Apia Magnetic Observatory
Box 52
Apia, Western Samoa
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Geomagnetska Observatora
Kod Beograda
Grocka, Yugoslavia
(Grocka)

AURORAL AND AIRGLOW OBSERVING STATIONS

Excerpts from a letter dated 6 May 1969 from the Aurora and Airglow Committee (A. Omholt, G. Weill and M. H. Rees, reporters) is given below:

Dear Colleague,

The AAPC (Aurora and Airglow Programme Committee) of IAGA in a circular letter dated 8 May 1968 recommended several scientific projects which require close international collaboration to assure success. Working Group 8 of IUCSTP endorsed these projects and formulated general recommendations to bring the importance of world wide participation to the attention of the scientific community at large. Briefly, these projects are: 1) High latitude aurora, positive ion precipitation and spectral characteristics as a function of latitude, 2) Low latitude aurora and middle latitude red arcs, and 3) Photoelectron effects on airglow.

It appeared desirable at this time to list all observing stations which have or will have the capability of making instrumental measurements of optical (spectroscopic, photometric, etc.) radiations during the next few years. Such a list will provide experimenters with knowledge about similar or complementary work being carried on in other parts of the globe. We have started such a list, calculating the conjugate location for each station and the associated L-shell value for two altitudes, 100 km and 400 km. We also list the scientist responsible for each station, the address, and other useful information. The list we have at this time is appended.

We are fully aware that the present list is incomplete. We have, for example, no stations listed for Australia, New Zealand, South America, and Antarctica, although we know that stations exist. We therefore request that you please:

1. Send to the Reporter the geographic coordinates (to the nearest minute if available) of any station not listed, including type of measurements made, instrumentation, scientist and mailing address (telephone number).
2. Call attention to errors in the list appended, and offer suggestions, and
3. Bring the content of this letter to the attention of interested individuals who may not be aware of the international collaboration effort which IAGA and IUCSTP have recommended for the investigation of high and low latitude aurorae, mid-latitude red arcs and photoelectron studies.

STATION	GEOGRAPHIC COORDINATES		L-VALUE AT 100-km	CONJUGATE INTERCEPT	
	LAT	LONG		LAT	LONG
Debrezeit	N8.75	E38.96	On Geomagnetic Equator		
Adi-Ugri	N14.	E38.82	" "	"	
Mt. Abu	N24.60	E72.70	1.04	S6.93	E 74.63
Jicamarca	S11.95	W76.87	1.06	**	**
Haleakela	N20.80	W156.50	1.15	S20.45	W164.82
Gulmarg	N34.05	E74.40	1.23	S16.46	E77.91
Teide	N28.30	W16.45	1.24	S16.29	W4.78
Limbe	S15.80	E35.05	1.26	N33.29	E31.99
Yabuhara	N35.93	E137.84	1.26	S19.01	E136.21
Nobeyama	N35.93	E138.48	1.26	S19.03	E136.77
Niigata	N37.70	E138.82	1.30	S20.66	E136.95
Sendai	N38.10	E140.55	1.32	S21.08	E138.40
Tsumeb	S19.72	E17.72	1.37	N36.39	E9.94
Granada	N37.00	W3.50	1.45	S23.23	E8.81
Arecibo	N18.40	W66.90	1.45	S47.21	W65.55
Abastumany	N41.75	E42.83	1.56	S26.22	E49.70
Johannesburg	S26.07	E28.10	1.57	N41.47	E 19. 25
Kitt Peak	N31.83	W111.60	1.67	S43.85	W130.46
Haute Provence	N43.92	E5.72	1.76	S31.39	E20.18
Valensole	N43.85	E6.00	1.76	S31.22	E20.30
Bologna	N44.60	E11.35	1.78	S31.39	E24.68
Zeekoegat	S33.10	E22.50	1.83	N45.23	E7.42
Stellenbosch	S33.93	E18.85	1.84	N44.99	E2.18
Socorro	N34.07	W106.88	1.86	S48.02	W128.01
Fritz Peak	N39.87	W105.52	2.35	S54.28	E132.19
Lindau	N51.50	E10.00	2.36	S42.23	E31.30
Exeter	N50.73	W3.64	2.43	S45.08	E21.87
Oxford	N51.77	W1.25	2.51	S45.89	E24.66
Green Bank	N38.48	W79.66	2.62	S64.75	W96.32
Svenigorod	N55.72	E36.85	2.63	S43.11	E56.36
Richland	N46.40	W119.92	2.75	S53.74	W152.01
Ann Arbor	N42.40	W83.93	3.09	S66.74	W107.64
Blue Hill	N42.22	W71.11	3.10	S70.61	W77.70
Yakutsk	N62.05	E129.67	3.12	S42.53	E127.22
Leningrad	N59.95	E30.30	3.27	S48.99	E56.91
White Face Mt.	N43.88	W71.47	3.37	S72.12	W79.42
Uppsala	N59.80	E17.60	3.40	S51.64	E48.55
Kerguelen	S49.35	E70.22	3.72	N62.92	E45.13
Lillehammer	N61.15	E10.46	3.80	S55.06	E46.67
Lerwick	N60.13	W1.18	3.86	S57.56	E38.51
Saskatoon	N52.10	W106.60	4.41	S64.14	W149.24
Lycksele	N64.62	E18.67	4.49	S56.45	E57.55
Tromsø	N69.67	E18.95	6.39	S60.56	E67.24
College	N64.88	W148.05	5.48	S56.71	E168.25
Kiruna	N67.83	E20.43	5.53	S58.81	E64.26
Ft. Churchill	N58.80	W94.20	8.67	S74.36	W153.74
D'Urville	S66.66	E140.01	38.	N80.96	W136.30

Particulars on low and middle latitude aurora-airglow observing stations.

Haute Provence Observatory, 04-St. Michel-L'Observatoire, France;
Scientist: G. Weill; Observers, J. Marsan, G. Camman; Telephone 92-
16 in St. Michel (through Manosque). Telex: 41690
Adi-Ugri Airglow Station, Tigre, Ethiopie; Observer: J. L. Chevassut
Debrezeit Airglow Station, c/o S. A. O. P.O. Box 1176, Addis Ababa,
Ethiopie; Observers: P. Gouin, M. Zecharias
Limbe, Malawi; Observer: R. Wiens
Zeekoegat Airglow Station, P.O. Box 3, Prince Albert, Cape Province,
South Africa; Observers: J. and (Mme.) E. Etienne
Valensole, France; Scientist, Mme. Vassy, Universite de Paris,
Observer: Mlle. Bizien
Teide Observatory, Teneriffe, Spain; Scientists: Sr. Sanchez and
Martinez, Madrid University
Stellenbosch, University of Stellenbosch, Department of Physics, South
Africa; Scientist: Pr. Zeeman; Observer: M. Steyn
Johannesburg, NITR:CSIR, P.O. Box 3718, Johannesburg, South Africa;
Scientist: R. W. Vice
Lindau, Max Plank Institut fur Aeronomie, 3411 Lindau/Harz, W. Germany
Telephone 05556-411; Scientist: G. Lange-Hesse; Observer: H. Lauche
Granada, Observatorio de Cartuja, Granada, Spain, Telephone: 31033;
Observers: E. Battaner, A. Rolland
Tsumeb, Research Station Tsumeb, P.O. Box 621, South West Africa,
Telephone Tsumeb No. 24M; Observers: J. Dachs, Sturm, B. Jung,
M. Lauche
Oxford, Clarendon Laboratory, Oxford, England, U.K.; Scientists:
C. D. Walshaw, R. P. Wayne
Exeter, University of Exeter, England, U.K.; Scientists: K. Weekes
Fritz Peak, Aeronomy Laboratory ESSA, Boulder, Colorado, USA;
Scientist: M. Gadsden
Arecibo, Arecibo Ionospheric Observatory, Box 995, Arecibo, Puerto
Rico; Telephone 809-891-1510; Scientist: H. Carlson
Jicamarca, Canyon of Jicamarca, Instituto Geofisico del Peru, Apartado
1155, Lima, Peru; Scientists: V. Peterson, T. VanZandt
Blue Hill, Blue Hill Observatory, Milton, Massachusetts, USA;
Scientists: J. Noxon
Ann Arbor, Space Physics Research Laboratory, University of Michigan,
Ann Arbor, Michigan, USA; Scientists: P. Hays, A. Nagy
College, Geophysical Institute, College, Alaska, USA; Scientist: G. J.
Romick
Tromso, The Auroral Observatory, Tromso, Norway; Scientist: O. Holt

Note: This list is incomplete and we request that you please send
relevant information on missing stations. Corrections are also
solicited

Instrumentation at Aurora-Airglow Observatories (Incomplete list)

Lindau, Scanning photometer, 5577A, 6300A; all sky camera

Granada, Scanning photometer, 5577A, 6300A

Tsumeb, Scanning photometer, Zenith photometer, 5577A, 6300A, 5200 A, H α

Oxford, Interferometer, 8600A O $_2$

Stellenbosch, Scanning photometer, 6861A, 6300A, 5577A, 5300A, 4000A, 3914A

Sendai, Photometers and spectrometers

Yabuhara, Photometers

Gulmarg, Photometer, 6300A, 3914A

Mt. Abu, Photometer, 6300A, 3914A

Fritz Peak, Photometers, Spectrometers, Interferometer, 5577A, 6300A, Na, 5200A, H β

Arecibo, Photometer, 5577A, 6300A

College, Photometers, spectrometer, 5577A, 6300A, N $_2^+$, Na, H, i. r.

Richland, Photometer, 5577A, 6300A

Blue Hill, Spectrometer, Interferometer, Polarimeter, 5577A, 6300A

Ann Arbor, Interferometer, Photometer, 5577A, 6300A

Just before this News was to go to press the Secretary received another letter from the same committee indicating that responses to the first letter had created a supplementary list greater than that contained in the original letter. Because of lack of time the supplementary list is included here rather than trying to collate it with the original list.

(Supplementary List)

STATION	GEOGRAPHIC COORDINATES		L-VALUE AT 100-km	CONJUGATE INTERCEPT	
	LAT	LONG		LAT	LONG
Kodaikanal	N10.20	E 77.50	On Geomagnetic Equator		
Huancayo	S12.04	W 75.32	" "		
Abra Pampa	S22.90	W 65.60	1.10	S 4.87	W66.07
Raratonga	S21.20	W159.80	1.15	N20.03	W151.55
El Leoncito	S31.80	W 69.50	1.17	N 3.84	W 68.96
Dodaira	N36.00	E139.33	1.26	S19.11	E137.51
Townsville	S19.13	E146.70	1.26	N35.45	E150.25
Bariloche	S41.10	W 71.30	1.31	N12.71	W 69.86
Memambetsu	N43.92	E144.33	1.52	S26.53	E140.85
*Socorro	N33.98	W107.18	1.85	S47.81	W128.22
Liege	N50.62	E 0.37	2.37	S43.53	E 24.10
Fan Mt.	N37.87	W 78.70	2.56	S64.52	W 94.06
Lauder	S45.05	E169.67	2.69	N55.69	W164.40
*Richland	N46.29	W119.41	2.75	S53.86	W151.47
Laurel Ridge	N40.17	W 79.17	2.82	S65.55	W 96.43
Sunya	N42.68	W 73.83	3.19	S70.56	W 85.44
York	N43.83	W 79.92	3.37	S69.72	W101.04
*Whiteface Mt.	N44.38	W 73.85	3.47	S72.14	W 86.53
Ås	N59.67	E 10.78	3.48	S53.24	E 44.18
Yarensk	N62.17	E 49.12	3.53	S47.90	E 72.20
Ottawa	N45.20	W 75.47	3.63	S72.47	W 91.57
Banff	N51.14	W115.58	3.70	W59.35	W154.74
*Kerguelen	S49.35	E 70.20	3.72	N62.92	E 45.10
Algonquin	N45.95	W 78.05	3.78	S72.33	W 98.85
Sanae	S70.00	W 2.00	4.00	N52.61	W 43.01
Campbell Isl.	S52.55	E169.15	4.08	N61.88	W154.50
Moosonee	N51.28	W 80.63	5.23	S75.93	W113.45
Kotzebue	N66.87	W162.63	5.24	S54.36	E160.13
Macquarie	S54.67	E158.95	5.46	N67.71	W163.25
Tungsten	N61.95	W128.23	6.16	S61.40	W179.22
Ft. Yukon	N66.57	W145.28	6.50	S58.61	E166.91
Great Whale	N55.30	W 77.75	7.01	S80.29	W116.82
Byrd	S80.00	W119.51	7.19	N55.36	W 79.37
*Ft. Churchill	N58.76	W 94.00	8.66	S74.44	W153.44
Mawson	S67.60	E 62.86	8.90	N71.03	W 5.02
South Pole	S90.00		13.70	N63.41	W 67.01
Davis	S68.58	E 77.96	14.22	N76.19	W 2.27
Ny-Alesund	N78.93	E 11.94	16.64	S66.69	E 89.28
Scott	S77.80	E166.80	32.98	N69.48	W 91.53
Casey	S66.28	E110.54	38.20	N87.86	E 34.85

*Correction to previous list (May 6, 1969)

Particulars on Aurora-Airglow Observing Stations (supplementary list)

- *Valensole, France; new address of Mme. A. Vassy, Laboratoire de l'Atmosphere, Tour 14, 9, Quai Saint Bernard (75), Paris 5e
- Socorro, New Mexico, USA, B. Tinsley, Southwest Center for Advanced Studies, P.O. Box 30365, Dallas, Texas 75230. Telephone 214-231-1471.
- Abra Pampa, El Leoncito and Bariloche, Argentina; Ind. Evan Ciner, Observatorio Astronomico "Felix Aguilar", Facultad de Ingenieria, U. Nac de Cuyo, San Juan, Prov. de San Juan, Argentina.
- Casey, Davis, Macquarie Isl., Mawson, Australia; F.R. Bond, P. H. Sulzberger, Antarctic Division, Department of Supply, 568 St. Kilda Road, Melbourne, Victoria.
- Raratonga, New Zealand; Dr. G. A. M. King, Geophysical Observatory P.O. Box 2111, Christchurch, New Zealand. Telephone Christchurch 65-349.
- Scott Base, Antarctica; Dr. G. F. Stuart, Physics and Engineering Lab., Private Bag, Lower Hutt, New Zealand. Telephone, Wellington 699-199.
- Liege, Belgium; R. Duysinx and J. C. Gerard, Institut d'Astrophysique, Cointe, Sclessin, Belgium; Telex: Astro-Liege 41264
- *Johannesburg, South Africa; Dr. M. R. Torr, N.I.T.R., C.S.I.R., P.O. Box 3718, Johannesburg, South Africa. Telephone 724-8221.
- Sanae, Antarctica; Prof. P. Zeeman, Stellenbosch University, Stellenbosch, South Africa.
- *Tromso, Norway, Ny-Alesund, Spitzbergen; G. J. Kvifte, The Auroral Observatory, P. B. 387, 9001, Tromso, Norway. Telephone 2398; Telex, 3524 - Aurora TOE.
- Ft. Yukon, Kotzebue, Alaska, Tungsten, N.W.T., Canada; G.J. Romick, Geophysical Institute, University of Alaska, College, Alaska 99701. Telephone 907-479-7381.
- Ottawa, Algonquin, Churchill, Moosonee, Great Whale, Bydr; Dr. P. M. Millman, Upper Atmosphere Research, Radio and Electrical Engineering Division, National Research Council, Ottawa 7, Canada
- Banff, Alberta, Canada (Cosmic Ray Station), Sulphur Mt; R.J. Hoch, Batelle Northwest Laboratory, Rattlesnake Mt. Observatory, Box 999, Richland, Washington. Telephone 509-942-1111, Ext. 6-5136
- York, Canada; Dr. G. G. Shepherd, Centre for Research in Experimental Space Science, York University, Toronto 12, Canada. Telephone 416-635-3833.
- Memambetsu, Japan; M. Nagamine, Memambetsu Magnetic Observatory, Hokkaido, Japan.
- Dodaira, Japan; Prof. M. Huruata, Tokyo Astronomical Observatory, Mitaka, Tokyo, Japan.
- Townsville, Australia; Prof. J. F. Ward, Dept. of Physics, U. of North Queensland, Box 999, Townsville, Zld. 4810, Australia. Telephone 79-2193.

*Correction to previous list (May 6, 1969).

Laurel Ridge, USA; T. M. Donahue and M. A. Biondi, Department of Physics, University of Pittsburgh, Pittsburgh, Pa. 15213, Telephone 412-621-3500; Observatory (R. D. Hake, Jr.). Telephone 814-445-4459.

Uppsala, Lycksele, Sweden; W. Stoffregen and H. Derblom, S-755-90, Uppsala, 1, Sweden. Telephone, Uppsala 30 93 26.

Byrd, South Pole, Antarctica; Dr. W. H. Campbell, Geomagnetism Laboratory, ESSA, Boulder, Colorado 80302, USA

Kitt Peak, USA; Dr. A. L. Broadfoot and Dr. D. M. Hunten, Kitt Peak National Observatory, Box 4130, Tucson, Arizona 85717, USA. Telephone 602-327-5511.

Lauder, Campbell Isl., New Zealand; Dr. R. S. Unwin, PEL Auroral Station, Private Bag, Omakau, New Zealand. Telephone Omakau 99.

Whiteface Mt., Fan Mt., SUNYA, USA; Prof. J. S. Kim, State Uni. of New York at Albany, Albany, New York, 12203, USA. Telephone 518-457-3989

Gulmarg, Mt. Abu, Kodaikanal, India; Prof. K. R. Ramanathan and Dr. P. V. Kulkarni, Physical Research Laboratory, Ahmedabad-9, India. Telephone 7076 or 79272.

As, Norway; Prof. G. Kvifte, Department of Physics and Meteorology, Agricultural College of Norway, 1432 Vollebkk, Norway. Telephone, As 901, Ext. 411-416. Observer: V. Hansen.

Zvenigorod, USSR: Yu. L. Truttse, N. N. Shefov, V. I. Krassovsky, Institute of Physics of the Atmosphere, USSR Acad. Sci., Pyzhevsky 3, Moscow Zh - 17, USSR

Lesuto, South Africa; Prof. E. H. Carman, Lesuto, Swaziland, P.O. ROMA, Lesotho, South Africa.

Richland, Washington USA: R. J. Hoch, Rattlesnake Mt. Aeronomy Observatory, Box 999, Richland, Washington 99352. Telephone 509-042-1111, Ext. 6-5136

Huancayo, Peru; Ing. D. Angel Velasquez and Dr. A. A. Giesecke Observatorio "John A. Fleming", Instituto Geofisico del Peru, Apartado 46, Huancayo, Peru.

Instrumentation at Aurora-Airglow Observatories (supplementary list)

Valensole, scanning photometer, 5577 Å, 6300 Å.
Socorro, grille spectrometer, H Balmer alpha, He $2^3P - 2^3S$.
Abra Pampa, El Leoncito, Bariloche, zenith photometer, scanning photometer, 5577 Å, 6300 Å, 5300 Å, 6080 Å.
Casey, Davis, Macquarie Isl., Mawson, all sky camera photometers 5278 Å, 5577 Å, 6300 Å, 4867 Å. (potential)
Raratonga, scanning photometer, 5577 Å, 6300 Å, 6330 Å.
Scott Base, all sky cameras
Liege, photometers, 6300 Å, 5577 Å, 3914 Å, scanning monochromator
SANAE, zenith photometer, 3914 Å, 4278 Å, 5577 Å, 6300 Å.
Trømsø, scanning spectrometers, zenith photometers (4278 Å, 5577 Å, 4861 Å), assorted photometers, all sky camera
Ny-Alesund, photometer, 4278 Å, all sky camera
Ft. Yukon, all sky camera, scanning photometer, image orthicon television, spectrograph.
Kotzebue, all sky camera
Tungsten, all sky camera
Banff, meridian spectrograph (aligned for triangulation through Richland station)
Ottawa, all sky camera, spectrometers, photometers
Algonquin, interferometer, spectrometer, all sky camera
Churchill, all sky camera, photometers, 4278 Å, 5577 Å, H-Balmer beta
Moosonee, all sky camera
Great Whale, photometers, all sky camera
Byrd, all sky camera, photometers, 4278 Å
South Pole, photometers, 4278 Å
York, spectrometer, interferometer, photometers, 5577 Å, 6300 Å, N_2^+ H-Balmer beta
Memambetsu, scanning photometer, 5577 Å, 6300 Å, spectrograph, all sky camera.
Dodaira, zenith photometer, 5577 Å, 6300 Å, spectrograph
Laurel Ridge, Wedge and Zeeman photometers (Na), interferometer, 5577 Å, 5890 Å, 5896 Å, 6300 Å
Uppsala, scanning photometer, 5577 Å, 4278 Å, 6300 Å, H-Balmer beta all sky camera
Lycksele, scanning photometer, 5577 Å, 4278 Å, 6300 Å, H-Balmer beta, all sky camera
Kitt Peak, large spectrometer, photometers, astronomical telescopes
Lauder, all sky camera, scanning photometer, 6300 Å, 5577 Å, 4278 Å, Na.
Campbell Isl., all sky camera
Whiteface Mt., scanning spectrometer, 5577 Å, 6300 Å, 6100 Å, 5300 Å, 8000 Å, all sky camera
Fan Mt., scanning photometer 5577 Å, 6300 Å, 7100 Å, 5300 Å, 8000 Å
Sunya, birefringent photometer, 5893 Å, 6707 Å, 7699 Å

- *Gulmarg, photometer, 6300 A, 5577 A, 3914 A
- *Mt. Abu, photometer, 6300 A, 5577 A, 5893 A, OH (7-2), OH (8-3)
- Kodaikanal, zenith photometers, 5577 A, 6300 A, 5300 A
- As, spectrograph, spectrophotometer, (alkali metals, OH, H-Balmer alpha)
- Townsville, zenith photometer, 6300 A, 5577 A; scanning photometer 6300 A
- Zvenigorod, spectrophotometer, (visible and infrared).
- Lesuto, photometer, 5577 A, 6300 A.
- *Richland, scanning photometers (3) 4278 A, 5577 A, 6300 A, 5300 A, 6080 A, 7130 A, meridian spectrograph (aligned for triangulation through Banff Alberta).
- Huancayo, birefringent scanning photometer, 5577 A, 5893 A, 6300 A; scanning interference filter photometer, 5200 A, 6300 A; zenith photometer, 5577 A, 6300 A.

* Correction to previous list (6 May 1969).

A few comments, based on responses received to the 6 May 1969 letter are given below:

- a) The distinction between low, middle and high latitude stations is arbitrary; all airglow and auroral observatories can, in fact, provide input to the projects under investigation. The list, therefore, includes all potential observatoires, with the understanding that large values of the L-shell parameter (perhaps above 5 or 6) may lose physical significance. Conjugacy at high geomagnetic latitudes is obviously uncertain.
- b) The instrumentation list is necessarily abbreviated. Details may be obtained by writing to the appropriate scientist. Situations exist where more than one organization has instrumentation in the same location (e.g., Tromsø). All instrumentation has been combined in one list.
- c) The field computations refer to the November 1966 epoch.
- d) Corrections: Lillehammer has been discontinued and the instrumentation has been moved to Tromsø. Zvenigorod was spelled incorrectly with an S instead of a Z.
- e) Drs. G. J. Gassmann and B. P. Sanford call attention to two KC 135 aircraft equipped with photometers, spectrometers, interferometers and all sky cameras which have been used and will continue to be used for auroral and airglow investigations. The responsible scientists for these mobile observatories are, Dr. G. J. Gassman and Dr. B. P. Sanford.

LONG RANGE PROGRAM OF SOLID EARTH STUDIES

As a result of a decision taken at the ICSU General Assembly in Paris in October, 1968, an ad hoc Committee was organized consisting of members nominated by IUGG and IUGS for the purpose of considering an international program which would deal with problems regarding the solid earth in the 1970's.

Membership of the Committee consisted of B. Baker (IUGG), C.L. Drake, Chairman (IUGS), X. Le Pichon (IUGG), E. Lubimova (IUGG), D. McKenzie (IUGG), E. Niggli (IUGS), and T. Rikake (IUGG).

The committee was charged with the following:

- 1) to outline a program which made use of the discoveries made during the UMP and which would aim at obtaining information on the thermodynamic and structure of the lithosphere;
- 2) to plan an organization which would be set up to implement the program; and
- 3) to draft a report to both IUGG and IUGS on items (1) and (2) which could serve as a basis for proposals to be made to ICSU.

The ad hoc Committee held two meetings, one in Paris, France on 19-21 February 1969, the other in Cambridge, England on 1-3 May 1969. In developing its suggested program it recognized that the major advances to be made in the specified fields are likely to result from an interdisciplinary approach to the major problems and through close international cooperation. Thus the program and the suggested organization are organized along these lines. It will be necessary to create working groups which are so constituted that the major disciplines included in IUGG and IUGS are adequately represented.

The Committee further recognized that a large number of committees, commissions and associations of IUGG are concerned with interdisciplinary problems which are related to the proposed program and urges close coordination so that maximum benefit can be gained and unnecessary duplication of effort can be avoided.

The committee produced a very comprehensive final report dated July 1969 which contains 36 single spaced typewritten pages. Only an extremely brief synopsis of the report is contained in the following paragraphs since the entire project seems to relate much more closely to IASPEI than IAGA.

The surface of the Earth has mobility on both a long and short time scale. The short period motions, particularly those associated with earthquakes, volcanoes or such natural disasters as landslides are the most readily apparent, but the long-term motions have made the most striking alterations in the configuration of the Earth's surface. These longer-term motions vary in time scale from vertical uplift due to the melting of the glaciers over a few thousand years to horizontal motions over tens of millions of years believed by many to have shaped the oceans basins and intermittent movements over the course of geologic time which have deformed the organic belts and molded the continents into their present form. Their effects vary in size from tens or hundreds of meters to maybe as much as many thousands of kilometers. All parts of the Earth's surface, even those which are at present quite stable, have been affected by these motions. Yet we do not know the energy source which maintains the motions.

The Upper Mantle Project (UMP) has been a highly successful venture in coordinating and promoting international efforts to increase understanding of the nature of the outer 700 kilometers of the Earth. The research carried out during the period of the Upper Mantle Project has revealed many details of the properties and the structure of the Earth's outer shell that had not previously been recognized. It has further resulted in exciting and provocative ideas about the history and development of its surface features.

Among the major results which have emerged one is especially important. The Earth is not simply a radially symmetrical sphere, but the upper 700 kilometers or more has significant lateral inhomogeneity. These inhomogeneities may be the evidence for the driving mechanism for the motions and the motions, in turn, may provide the process whereby the inhomogeneities are produced. These results were unforeseen at the start of the UMP and have set the stage for a new approach to studies of the Earth, its history and the development of its surface features.

In the light of this work there are two obvious research directions which seem especially important to our understanding of the dynamical evolution of the earth.

The first is a better determination of the pattern of surface motions and deformations, especially those now occurring in the continents. Such deformation can now be precisely measured by several different methods.

The second is the mechanism by which the mantle provides the mechanical energy for surface motions. At present there exists no self consistent theory which can account for these motions, principally because of our general ignorance of the physical state of the Earth's interior. The relationship between these two parts is the central problem of geodynamics.

Thus a long-range program of research on the solid earth, concentrated especially on problems and processes related to deep-seated foundations of geological phenomena and to terrestrial dynamics, is necessary. This program should be of international and interdisciplinary character and should be sponsored by ICSU. The scope of investigations required that it be organized jointly by IUGG and IUGS and it should have active participation from other interested unions. To provide the necessary international and interdisciplinary coordination, it would be appropriate for national committees to be established and for an international committee to be appointed to provide information and guidance.

The history of studies of the Earth has been marked by the search for a suitable mechanism (or suitable mechanisms) to explain the origin and development of the features found at its surface. The search entailed accumulation of knowledge about the fundamental origin of the different rock types, the determination of their relative ages and times of emplacement, the manner in which they had been eaten away even after reaching a state of relative stability. The basic observations of geology were and are fundamental to the consideration of processes which have shaped the Earth's surface. The data from these observations are necessarily incomplete and, until fairly recently, suffered from the effects of political, disciplinary or geographic discontinuities. The insufficiency of data limits the sophistication of possible interpretation and results in gross generalization about the nature of processes which may not be in accord with detailed observations where they are available. It has long been recognized that, except for narrow mobile belts, most of the Earth surface is at present fairly stable. Most seismic and mechanical energy is released by the Earth in these mobile belts. Therefore, a complete understanding of their structure

and evolution is essential to geodynamics. At least from the point of view of present day tectonics, the seismic activity in such belts can be considered as produced by the interaction of several large blocks along their borders. Clearly, the origin of the seismicity and of fold mountains is in some related to the motions of the blocks.

These remarks suggest that the problem should be approached in two ways. The first must consist of a study of all relevant physical properties of the Earth's interior, especially of any evidence for motions at depth. Except for some very important evidence coming from geochemistry and petrology, our knowledge of the physics of the deep interior will rely mostly on laboratory experiments and theoretical studies.

The second concerns all observations relevant to past and present deformations of the Earth's surface. It should make use of all the geological, geophysical and geochemical methods available.

Wherever available, seismicity studies should provide a framework for other relevant observations, since earthquakes are directly produced by three dimensioned mass motions. In less active regions evidence for mass movements depends mainly on geological evidence, and is therefore more difficult to interpret in terms of actual motions. Consequently, it is proposed that a program of study of the dynamics of the Earth be divided into four main areas:

1. the physics of the interior, its properties and behaviour and the sources of energy for movements within it;
2. movements in the seismically active belts, and their relation to recent structural history;
3. the record of movements preserved in orogenic belts which give their paleodynamic history;
4. movements, present and past, and primarily vertical which occur within more stable areas.

The ad hoc Committee was asked to consider the question of organization for the program which it suggests. The Committee recognizes that it is not expert in this field and that the details of organization should be left to IUGG, IUGS and the permanent Committee. Thus it will limit itself to a discussion of principles rather than develop a complete organization plan.

Since it is the feeling of the Committee that the major advances in the earth sciences will be made through interdisciplinary approaches to the problems, the emphasis is in this direction. This was recognized by UMC as the UMP developed and resulted in the formation of commissions devoted to the study of such problems as the development of continental margins and island arcs and of the world rift system. It is accepted as the basic premise that the long range program should be founded on a broad, interdisciplinary approach to fundamental problems of the solid earth. These problems relate to basic science, practical economic problems and human welfare. The program should thus be dedicated to specific problems or tasks which will certainly be modified from time to time. The program relates to all solid earth disciplines as well as to social-economic aspects. It is evidently essential that it be guided by persons who represent both scientifically and organizationally the broad range of interests of ICSU, IUGG and IUGS, relating to the solid earth.

This program should provide a means for focussing the activities of the diverse committees and commissions of the unions towards these problems. With guidance provided by a committee including senior officers of ICSU and the unions, effective participation of these organizations should be assured. The strong, unequivocal support of the two primary sponsoring unions is a prerequisite to enlisting the energies of an imaginative, capable committee led by dynamic, selfless chairman and secretary.

This ad hoc Committee will base its recommendations upon the concept that the proposed program will be guided by a committee selected by IUGG and IUGS, and that its program will be a declared program of ICSU. This Committee should be an interunion committee of IUGG and IUGS and the program should be guided by it with the participation of other interested unions such as IUPAP, IUPAC, IUTAM, IMU, IAU, etc.

a. Administration

Administration of the program should be entrusted to a bureau which should be so constituted that it will be representative of the interests of the sponsoring unions. It should be of sufficiently limited size that it is viable and each of its members should have designated duties. The ad hoc Committee feels that members of the bureau should have a fixed term of office but that the length of these terms be adjusted so that all members do not leave office simultaneously.

Among the specific duties which might be considered by the members at large of the bureau are the following:

1. Data centers and information exchange.

The problem of information exchange is a complex one and one which changes with time as the geological and geophysical sciences develop. Workable channels of information exchange need to be maintained and the most useful method of operation of data centers must be established.

The purpose of the project is to encourage fundamental research on the dynamics of the Earth's interior and related phenomena and to provide a mechanism through which the results of this research can be made available to the scientific community and the public. Although its primary functions will relate to interdisciplinary programs necessary to produce broad understanding of particular problems and to programs which would naturally benefit from international planning and cooperation, it should encourage purely national efforts which relate to its over-all purpose.

It should be noted at the outset that some of the undertakings, suggested for completeness in the proposed program, are effectively under the guidance of existing committees or commissions and thus do not require detailed attention of the permanent committee that will guide the long range program. The permanent committee should lend its strong support to important activities, whether or not they fall formally under its cognizance.

The responsibilities of the proposed Committee would be threefold:

- a) Administration of the program
- b) Scientific Co-ordination
- c) Interunion Co-ordination

2. Coordination with other IUGG/IUGS Committees, Commissions, or Associations.

Since the proposed program is of an interdisciplinary nature, its interests will overlap the activities of existing IUGG/IUGS groups. In order to avoid duplication of effort and to provide affective communications, a member of the bureau should be assigned responsibility in this area.

3. Symposia and Publications.

Although the Secretary General should be responsible for the details of special symposia, it would be useful if a member at large were to assume responsibilities for organization of programs for symposia and ensuring that the proceedings of the symposia are published with dispatch.

4. Data Synthesis.

Many of the major concepts of the deformation of the Earth and the dynamics of its interior are based upon data from areas on the scale of the Earth intelligently or at least imaginatively interpreted. There are some specialized types of data which pertain to the primary focus of the project but which are not at present being assembled and the compilation of which might be assisted if it were recognized as being part of an international program. The bureau might consider assigning a member to provide communication and support for such activities.

b. Scientific Coordination

Four main areas of endeavour have been suggested. It will be the responsibility of the permanent committee to establish formal working groups which should be organized along interdisciplinary lines, and chaired by reporters who would be members of the full committee. The scientific fields to be covered by these working groups are as follows:

- 1) Rheology and Physics of the Deep Interior
- 2) Dynamics of Seismic Belts
- 3) Paleodynamics
- 4) Dynamics of the More Stable Areas

Since these subjects are problem oriented and interdisciplinary rather than discipline oriented, it is of utmost importance that the membership of the working groups, although limited in number, reflect the combination of scientific

skills necessary to cover the subject adequately. The permanent committee should seriously consider the possibility of establishing commissions of limited life to represent regional projects of international character which are related to the over-all program.

c. Interunion Coordination

It would be appropriate to establish an advisory council to provide effective coordination among unions and with other official bodies. It should consist of the General Secretaries of ICSU, IUGG and IUGS, representatives from other unions which may become affiliated with the program, the Past Chairman of the Bureau (initially the Past Chairman of UMP) and an observer from UNESCO.

IV FUTURE MEETINGS

SYMPOSIUM ON SOLAR-TERRESTRIAL PHYSICS

Excerpts from the first circular for the International Symposium on Solar-Terrestrial Physics 1970 (Sponsored by IAU, IUGG/IAGA, URSI, and COSPAR), Leningrad, USSR, May 1970 are given below:

The International Symposium on Solar-Terrestrial Physics will be held 12-20 May 1970 in Leningrad, USSR, immediately before the 13th Plenary Meeting of COSPAR. The program and schedule are still tentative. The next Circular, to be circulated in early autumn 1969, will carry further details.

1. Auspices.

This Symposium is being organized under the joint sponsorship of the International Astronomical Union (IAU), the International Union of Geodesy and Geophysics (IUGG) through its International Association of Geomagnetism and Aeronomy (IAGA), the International Union of Radio Science (URSI), and the ICSU Committee on Space Research (COSPAR). This Symposium may be regarded as a member of the series that includes the Symposium on Solar-Terrestrial Physics (Belgrade, September 1966) and the IQSY-COSPAR Symposium on the Results of the IQSY (London, July 1967). This Symposium will take the place of COSPAR's annual invited symposium on a solar-terrestrial subject.

2. Organization (Program Committee).

The Program Committee comprises two representatives from each of the sponsors, as follows:

IAU: Dr. Z. Svestka and Prof. C. de Jager

IUGG/IAGA: Dr. Francis S. Johnson and Mme. Dr. V. A. Troitskaya

URSI: Prof. S. A. Bowhill and Dr. J. W. King

COSPAR: Dr. H. Friedman and Prof. N. V. Pushkov

Prof. J. D. Roederer, Chairman of the IAGA Symposium Program Committee, also sits with the International Symposium Committee.

Dr. H. Friedman is Chairman of the Program Committee, and Dr. Troitskaya is Co-Chairman; enquiries and correspondence concerning the symposium should be addressed to: Dr. E. R. Dyer, Jr., Secretary International Symposium on STP 1970, c/o IUCSTP Secretariat, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D. C. 20418 USA.

A Local Organizing Committee is now being established in the USSR.

3. Program.

The Symposium will be divided into five main subjects, as outlined below:

THE PROTON FLARE PROJECT

The treatment of this session will be different from blocks I-IV below. It will be organized separately by Dr. Z. Švestka, Ondřejov Observatory near Prague, Czechoslovakia, and Dr. P. Simon, Section d'Astrophysique, L'Observatoire de Paris, 92 - Meudon, France, Leaders of IUCSTP Working Group 2 on this subject. Detailed plans for this session will be formulated after the Proton Flare Project observing interval, 1 May - 31 July 1969, is ended.

The other blocks are as follows:

I. THE SUN AS A SOURCE OF ENERGY AND DISTURBANCES

1. Complexes of activity and active regions on the Sun
2. Permanent sources of particle emission from the Sun
3. Sources of sporadic ejections of energetic particles and plasma
4. Ultraviolet, X-ray, and microwave sources on the Sun
5. Theoretical problems of particle acceleration and plasma ejection
6. Solar activity variation and forecasting methods

II. THE INTERPLANETARY MEDIUM

1. Plasma and magnetic field configuration
2. Energetic particle propagation and modulation
3. Interaction of the solar wind with Earth, Moon, and planets

III. THE MAGNETOSPHERE

1. The quiet magnetosphere
2. Time variations
3. The magnetospheric substorm and polar electrojets
4. Wave-particle interactions and instabilities
5. Diffusion and acceleration processes

IV. UPPER ATMOSPHERE PHYSICS

1. Interactions between the magnetosphere and the ionosphere, including auroral and PCA phenomena
2. Structure of the plasmasphere
3. The exosphere and geocorona, including the polar wind
4. The F-region during magnetically disturbed conditions
5. Processes affecting the density, composition, and dynamics of the thermosphere
6. Electric fields and their effects in the ionosphere
7. Chemistry and aeronomy of the D and E regions

8. Interpretation of ionospheric measurements made during solar flares
9. Photochemistry of planetary upper atmospheres
4. Probable Duration and Scheduling (Tentative).

The first day will be devoted exclusively to the Proton Flare Project. The following six week days will be devoted to the other blocks in two parallel sessions, probably as follows:

Monday, 11 May:	Registration and Opening Ceremonies
Tuesday, 12 May:	Proton Flare Project
Wednesday to Friday, 13-15 May:	Parallel Sessions on I. The Sun and III. The Magnetosphere
Monday to Wednesday, 18-20 May:	Parallel Sessions on II. The Interplanetary Medium and IV. Upper Atmosphere Physics

The number of sessions per subject is not yet fixed, and will depend on the number of papers accepted.

5. Submission of Papers.

In June 1969, the Program Committee will issue invitations for a number of review papers. These will be scheduled in the morning sessions of one parallel sequence and in the afternoon sessions of the other, so that it will be possible to hear all the reviews if anyone wishes.

Guidelines for the submission of contributed papers, including the scope and emphasis under each subtopic above, will be carefully defined in the next circular. Contributed papers for Blocks I -IV above should emphasize the physical interpretation of phenomena. COSPAR will still receive its usual contributions on latest results and the two Committees (STP Program and COSPAR) will work closely together. Deadline for the submission of abstracts to the STP Symposium will be 1 December 1969. This will allow time to resubmit to COSPAR those papers deemed by the STP Committee to be more suitable for COSPAR Working Group Meetings.

6. 2nd Circular.

The 2nd Circular, continuing a form for prospective authors and information as available on travel and local arrangements will be mailed in September 1969. Those who received a copy of this circular indirectly and who wish to be placed on the direct mailing list are requested to notify the Secretary.

SYMPOSIUM ON SOLAR REGULAR DAILY GEOMAGNETIC VARIATIONS.

An International Symposium on solar regular daily geomagnetic variations will be held in April, 1970, in Potsdam, GDR. It will be organized by the German Academy of Sciences at Berlin and sponsored by the National Committee for Geodesy and Geophysics of the German Democratic Republic. It will take place in the Central Institute for Physics of the Earth, Potsdam.

The aim of this Symposium will be to give a view on the recent results and developments in the field of daily variations, and especially to clarify where we stand in: the data analysis, the theoretical description, and the comparison of morphological and theoretical results.

The main topics of the sessions shall be

A. From the theoretical point of view:

1. The three-dimensional treatment of dynamo effects, including field aligned currents through the magnetosphere.

B. From the morphological point of view:

1. New important morphological results (e.g. corresponding to the UT-part of the variation, the semi-annual variation, effects near the electrojets, fine structure etc.);
2. The calculation of daily current systems using computers and data from groundbased and satellite born instruments;
3. Methods for the investigation of current systems connecting magnetosphere and ionosphere.

It is intended to have at most four invited papers as a kind of introduction to the four topics. In addition contributed papers (about 10 min.) should be given.

The meeting will have the character of a business meeting or a working session with many periods for discussions.

All scientists interested in the above mentioned topics are invited to participate in the Symposium. Those wishing to submit a paper are kindly requested to inform

Dr. G. Fanselau
GDR-15 POTSDAM
Telegrafenberg

before December 15th, 1969, sending the title and an abstract of the report.

Further details concerning the Symposium will be issued later.

XV GENERAL ASSEMBLY

The IUGG XV General Assembly will be held in Moscow from Monday 2 August until Saturday 14 August 1971. Many details of this important Assembly were discussed at the IAGA Executive Committee meeting and the IUGG Executive Committee meeting held in Madrid in September 1969.

Dr. V.V. Belousov from the USSR presented general plans for the Assembly some of which are given below

- 1) The registration fee for delegates and guests will be \$ 22.⁰⁰. The registration fee for family members will be \$ 11.⁰⁰.
- 2) The "Intourist" will offer to foreign participants the following accommodations and services:

category "A" hotel (with bath)	17.00 roubles, single room 9.00 roubles, double room
category "B" hotel (without bath)	7.00 roubles, double room

(attempts will be made to obtain some student rooms at a lower rate) (\$ 1.⁰⁰ = 0.90 roubles)

These prices include:

- meeting and seeing-off by cars;
- accommodation in hotel in accordance with the purchased class of service;
- breakfast and lunch according to class of service;
- transportation by buses to place of meeting and back every day;
- excursions in town with guide - interpreter by bus.

- 3) The following scientific excursions are being planned for IAGA:

- Institute of Physics of the Earth (Moscow), and its station in Borok;
- Institute of Geomagnetism, Ionosphere and Radio-wave Propagation, IZMIRAN (Moscow), and its Station in Voieikovo and Arkhangelsk;
- Institute of Atmospheric Physics (Moscow), and its station in Zvenigorod;

- Polar Geophysical Institute (Murmansk), and its stations in Apatity and Loparskoye;
 - Leningrad State University;
 - Institute of Applied Geophysics (Moscow), its station in Volgograd.
- 4) The second circular which will be published in August 1970 will contain a calendar plan, prices, excursions, and necessary registration forms.
 - 5) The scientific meetings will be held in the auditoriums of the Moscow State University. The opening plenary session will be held in The Palace of the Kremlin.

During the IUGG Executive Committee meeting the following decisions were made:

- 1.) Abstracts of all papers must be in the hands of the Association secretaries not later than 15 March 1971.
- 2.) Complete photo-ready copies of Association programs including interdisciplinary symposia assigned to each Association must be in Moscow no later than 1 May 1971.
- 3.) A standard format will be specified for abstracts.
- 4.) Associations should live within the spirit of the 1969 decision to emphasize interdisciplinary topics in Moscow. This means for IAGA that great care must be exercised in setting up Scientific Sessions of IAGA Commissions.
- 5.) IAGA was given the responsibility to convene the following symposia:
 - a. Solar Corpuscular Effects on the Troposphere and Stratosphere.
 - b. Electric Fields in Space and their Connection with Atmospheric Effects.
 - c. Automatic Acquisition of Data and Time Series Analysis.
 - d. Aurora and Airglow - All aspects.
 - e. Structure and Evolution of the Earth and Planets.

- f. Morphology and Physics of Magnetospheric Substorms.
 - g. Lunar Variations in Geophysical Phenomena.
 - h. Conductivity in the Earth.
- 6.) Twenty nine different interdisciplinary symposia with perhaps a total of almost 100 sessions are being planned.

V EXECUTIVE COMMITTEE MINUTES

IAGA EXECUTIVE COMMITTEE MEETING Washington, D. C. 23 October 1968 MINUTES

The meeting was called to order at 7:30 p.m. in the U. S. National Academy of Sciences by President Takesi Nagata. The following were in attendance:

T. Nagata -----President
L. R. Alldredge -----General Secretary
R. M. Casaverde ----- Member
F. S. Johnson ----- Member
J. R. Roederer ----- Member
R. Turajlic ----- Member
A. P. DeVuyt ----- Commission I, Chairman
B. R. Leaton ----- Commission II, Chairman
T. Rikitake ----- Commission III, Chairman

The last three were invited to attend by the President because of the importance of the forthcoming General Scientific Assembly in Madrid.

General Scientific Assembly in Madrid

The request to J. G. Roederer from R. Lust for Working Group No. 9, on Free Space, of the Joint IAGA-IAMAP Committee on Atmospheric Electricity, to cosponsor the IAGA Commission V on "Electric Fields in the Magnetosphere" was denied for reasons explained under Relations with Other Organizations.

President Nagata urged all Commission Chairmen and special Madrid Symposia Program Chairmen to plan early to ensure a good scientific assembly in Madrid in September 1969.

It was noted that the Joint IAGA-IAMAP Committee on Atmospheric Electricity plans to arrange two half day symposium on "Electrical Processes and Problems of Measurement in the Upper Atmosphere of Earth and Other Planetary Atmospheres" (this was approved provided it would be concerned only with region beneath the ionospheric E region) and a half day symposium on "Instrumental Observations of Thunderstorms."

President Nagata has reached agreement with URSI that they will cosponsor the symposium on "Comparison of the Magnetospheric Behavior with Ground Observations and New Indices of Geophysical Activities." URSI has added Drs. J. W. Dungey and B. Hultquist to the program committee. (See IAGA News No. 7, page 23.) URSI has

been invited to add a third member to the committee. Drs. T. Nagata, C.O. Hines and H. G. Booker will act as consultants. Note was taken of two letters from Dr. V.A. Troitskaya, chairman of the program committee for this symposium, outlining scientific plans for the symposium. It was the general consensus that her plans were a little too broad and should be limited to only those features of interest to ground and space correlated. Dr. Roederer, cochairman of the program committee, will convey this idea to Dr. Troitskaya.

Dr. J. Verhoogan has been added as an IAGA member on the program committee for the IAGA-IASPEI Symposium on "Geophysical Studies on the Evolution of the Earth's Deep Interior." He replaces the late Dr. E.H. Vestine.

It was agreed that Commission IV should hold a scientific session on "Instabilities in the Magnetosphere" as had been suggested by Dr. M. Sugiura to Dr. J. A. Jacobs.

It appears now that the due date for abstracts to reach the General Secretary can be relaxed from 1 May to 1 June 1969.

It was agreed that the following would be suitable for the IAGA opening scientific plenary session:

1. Highlights of the Magnetospheric Physics Symposium in Washington (plus newer developments) - N. Ness
2. The International Geomagnetic Reference Field - A. J. Zmuda
3. Presidential Address "Tectonomagnetism" - President T. Nagata

The General Secretary will invite the above speakers.

The other arrangements for Madrid as given in pages 21-25 and 63-71 of IAGA News No. 7 were approved.

Symposia and Special Meetings

Dr. G. Fanselau's proposal to hold a working session in Potsdam on "Daily Variations" immediately following the Madrid assembly was approved providing Dr. D. J. Stone, reporter of Working Group IV_g, on Daily Variations, approves and attests there will be no overlap with his program in Madrid and provided no IAGA funds will be required.

The Inter-Union Symposium on Solar-Terrestrial Physics will be held in Leningrad either immediately before or after the COSPAR meeting in 1970. Dr. H. Friedman is program chairman and Dr. V. A. Troitskaya is cochairman. Dr. Roederer, chairman of the IAGA program committee for this symposium, prepared fairly detailed plans for part of this symposium and solicited comments.

Drs. W. H. Campbell and S. Matsushita have requested formal IAGA cosponsorship of an International Symposium on Upper Atmospheric Currents and Electric Fields scheduled for Boulder, Colorado, in the summer of 1970. It was learned that there is some pressure to remove the term "International" from the title because of a possible conflict with the Leningrad symposium. It was agreed that IAGA would co-sponsor only if the title still indicated that it was International.

The new rules for IUGG assemblies require that scientific meetings should be confined to joint sessions of two or more associations on topics of interdisciplinary character decided one year in advance by the Union Executive Committee. Accordingly it was decided that the following topics would be desirable at the XV General Assembly to be held in Moscow, 2-13 August 1971:

1. Ocean Floor Spreading with IAPO, IAG, IASPEI
2. Energetics and Dynamics of the Mesosphere and Lower Thermosphere with IAMAP (proposed by Dr. J. London of IAMAP).
3. Physics of the Moon with IASPEI, IAVCEI

The General Secretary will write to the Associations involved and to Dr. G. D. Garland.

A three day symposium will be held during the next COSPAR Plenary meeting (Prague, 1969) on:

1. Atmospheric Hydrogen
2. Thomson Scattering
3. F - Region and Winds

as suggested by the IUGG (IAGA) and URSI representatives in COSPAR. Dr. Nicolet is looking out for the IUGG interests.

Commission Memberships

Dr. L.R.O. Storey was approved as reporter for Working Group V₃ "Field Interactions." It now appears that Working Group V₅ has invited 17 individuals to become members. Dr. Roederer was instructed to clarify this and to make sure the final number of official members does not exceed 12.

Publications and Finances

The General Secretary was instructed to pay the additional approximately \$3,100 required by the Norwegian organizing committee to cover the cost of 1,000 copies of IAGA Symposium No. 6, "The Birkland Symposium." The cost is approximately \$6,000 which is nearly double that expected.

It was decided not to purchase copies of what was to be IAGA Symposium No. 8, "Laboratory Measurements of Aeronomic Interest" because of the high cost (quoted at \$8,000 for 1,000 copies).

The General Secretary was authorized to pay up to \$2,000 to help publish the WMS report after other means such as UNESCO and IUGG are exhausted.

World Magnetic Survey (WMS)

Dr. A. J. Zmuda has been appointed as the new Secretary to the WMS Board.

Mr. J. H. Nelson was approved as a new member of the WMS Board.

Relations with Other Organizations

There will be a general meeting on the Solar-Terrestrial Physics Program in London, 27-28 January 1969. It was agreed that if IAGA representatives need financial help to attend (after IUGG sources are exhausted), the General Secretary was authorized to pay up to a total of \$1,000 for those named by President Nagata.

Dr. C.O. Hines has requested nominations of representatives from each IUCSTP subgroup of interest to IAGA to become members of IUCSTP Working Group No. 10, on Dynamics of the Upper Atmosphere, of which Dr. Hines is chairman. The General Secretary was instructed to get suggestions from Dr. F. S. Johnson by correspondence.

Dr. T. Rikitake was nominated as a member of the IUGG-IUGS ad hoc committee responsible for proposing a program for consideration by ICSU as a successor to the Upper Mantle project.

It was agreed that Dr. J. Vette should be asked if he is willing to represent the IUGG on an ad hoc committee of ICSU on Problems of Human Environment. If he agrees his nomination will be sent to IUGG.

Dr. J. Cain was nominated as an IUGG representative on an ICSU Panel on the WDCs (Geophysical and Solar). One of the duties of the panel is to revise the Guides for the WDCs.

Noting the persistent use of the term "Free Space" and the continuing attempt to emphasize "Space Electricity" by the IAGA-IAMAP Joint Committee on Atmospheric Electricity and further noting that this action has continued in spite of past statements by IAGA officials that this area of study is already properly covered by its regular commission structure, the Executive Committee instructed the General Secretary to notify the Joint Committee and IAMAP that IAGA would withdraw its sponsorship of the Joint Committee unless the Joint Committee abolishes Working Group No. 9, on "Free Space", or properly restricts its name and the activities of the Joint Committee to regions where the ionospheric E region is the outer conductor.

President Nagata asked the members of the Executive Committee to continue to study the problem of overlap of IAGA activities with URSI, COSPAR and IUCSTP and to think of how IAGA could be reorganized, perhaps in combination with other organizations, to best fill the need in this important area. This topic will be taken up at the next Executive Committee meeting which will be held in Madrid in 1969.

World Magnetic Archive Program

Note was taken of a hope expressed by Dr. Sydney Chapman to have the Executive Committee adopt and sponsor as an IAGA Executive Committee project the World Magnetic Archive Project. The Executive Committee endorsed the program and asked the chairmen of Commissions I and II to convene a meeting at the Madrid Assembly to discuss ways of executing the program.

IAGA EXECUTIVE COMMITTEE MEETING
Madrid, Spain 1 - 12 September 1969

MINUTES

Introduction

The Executive Committee met several times during the IAGA General Scientific Assembly held in Madrid, Spain, 1-12 September 1969. The first session was called to order by President Takesi Nagata at 1730 hrs on Monday 1 September. The final session was concluded at 1930 hrs on 12 September. The following Executive Committee members were present:

Takesi Nagata	-----	President
V.A. Troitskaya	-----	Vice President
L.R. Alldredge	-----	General Secretary
J.O. Cardús	-----	Member
M. Nicolet	-----	Member
J.G. Roeder	-----	Member
R. Rurajlic	-----	Member

The Secretary had received word prior to the Assembly that the following members could not attend the Assembly:

E. Thellier	-----	Vice President
R. M. Casaverde	-----	Member
F. S. Johnson	-----	Member

Commission Chairmen were invited to attend one of the sessions where the French proposal to reorganize ICSU was discussed.

New Personnel

Note was taken of a letter from Dr. E. Thellier to the Secretary indicating his inability to attend the Assembly because of ill health and his desire to retire from all International Administrative responsibility. The Secretary was instructed to write to Dr. Thellier to the effect that the Executive Committee wished to retain him as a Vice President hoping that his health would in time permit full activity, but that because of immediate need a replacement would be found as Reporter for Working Group III₅.

Several resignations were received from Working Group Reporters. After consulting with the proper Commission Chairmen, the following changes were approved:

R.L. Dubois to replace E. Thellier as Reporter for
W.G. III⁵

K.M. Creer to replace R.R. Doell as Reporter for W.G.
III⁶

I. Gough to replace K. Whitham as Reporter for W.G.
III³

Publications

The problem of the effectiveness and cost of the IAGA publications program was discussed at length. During the past five years IAGA has paid out \$15,817.00 for publications, but has received only \$4,208.00 for sales through the IUGG Publications Office in Paris. From an inventory of IAGA publications still held in Paris it is obvious that too many reprints of special issues of scientific journals have been purchased for resale under an IAGA Symposium cover. The sales go badly most likely because the special issue of the journal is available.

It was decided to be more discriminating as to which Symposia should receive IAGA publication support. For the present Assembly, all Symposium convenors are encouraged to have at least selected papers published in a special issue of a journal, but IAGA has pledged support only for the Symposium on "Multidisciplinary Studies of Unusual Regions of the Upper Mantle." In this case IAGA had agreed prior to the Assembly to help JGG (Japan) publish the proceeding of the Symposium by paying up to \$1,000.00. For this support IAGA will receive some reprints under a cover with the title IAGA Symposium No. 10.

IAGA is buying only about 200 or 300 copies of IAGA Bulletin No. 26, Program and Abstracts of the Madrid Assembly, for sale in Paris, and will publish only about 1,400 rather than the usual 2,000 copies of IAGA Bulletin No. 27, Transactions of the Madrid Assembly. For good will among IAGA Scientists and for promotional purposes, it was agreed that free copies of the Transactions of the Madrid Assembly should be sent to all participants and members of all Working Groups.

Publication of the WMS final report was considered as a special project. Because of its unique character it should have good sale value. Earlier the Executive Commit-

tee had pledged \$2,000.00 toward its publication. Recently the local committee for the Symposium on Description of the Earth's Main Field, Washington, D.C., October 1968, turned into the IAGA Treasury a profit of \$482.00 which has also been pledged toward the publication of the WMS final report. Dr. A. Zmuda gave several estimates for the publishing of this report. It was decided that the text of the report should be set in type, 2,000 copies of the text which is 200 pages long (including 66 pages of figures) should be published, and that 1,000 copies of grid values which contain 135 pages (not typeset) should be published. The total cost is estimated at \$8,500.00. Father Cardus suggested that the cost could be reduced by publishing in Spain. This will be investigated.

It was agreed that, since the WMS project is an ICSU project passed on to IAGA through IUGG, IUGG should be asked to share in the publication cost of the final report.

A request was made for IAGA to help finance the publication of some new work on magnetic indices. The request was not granted on the grounds that until new indices were accepted as a part of the permanent services the work should be considered as regular research work to be paid for by the institution or individual sponsoring the work. A policy was formulated to the effect that the main contents of IAGA Bulletins 12.1 and 12.2 should not be changed until proposals were approved by the IAGA Executive Committee.

Finances:

Informal financial accounts for the years 1967 and 1968 submitted by the Secretary were accepted without comment (formal accounting is required only at the time of General Assemblies.)

The Secretary presented a budget estimate for the four year period 1971-1974 given below as requested by the IUGG General Secretary. There is a general feeling that the entire financial support of the Union must be greatly increased if proper promotion of geophysics is to follow. The budget estimate was approved and it will be formally transmitted to IUGG. The main increases are mainly for increased costs for publications, meetings and administration. The latter point will be very important if future Secretaries are not well subsidized by their place of employment.

Estimate of Income and Expenses during the period 1971-1975

Receipts

IUGG Allocation	\$48,000.
Contracts with UNESCO	2,000.
Sales of Publications	<u>4,000.</u>
Total Receipts	\$54,000.
Cash Assets at start of Period	<u>10,000.</u>
	\$64,000.

Expenditures

Administrative	\$10,000.
Publications	16,000.
Assemblies	8,000.
Symposia	10,000.
Scientific Meetings	6,000.
Grants to Permanent Services	5,000.
Miscellaneous	<u>1,000.</u>
Total Expenditures	\$56,000.
Cash Assets at end of Period	<u>8,000.</u>
Total	\$64,000.

IUGG - IUGS Long Range Solid Earth Program

Note was taken of the very recent report of the IUGG-IUGS ad hoc Committee on Long Range Program of Solid Earth Studies. The report outlines a program which makes use of the discoveries made during the UMP and which aims at obtaining information on the thermodynamics and structure of the lithosphere, and suggests an organization which could be set up to implement the program. Discussion of the report was very limited and no objections to the report were voiced.

Potsdam Symposium on Solar Daily Geomagnetic Variations

Prof. G. Fanselau in a letter to President Nagata revealed plans for a Symposium on the Solar Daily Geomagnetic Variations to be held in Potsdam shortly before the 12-20 May 1970 Leningrad Symposium on Solar-Terrestrial Physics. As requested by Prof. Fanselau, it was agreed that IAGA would officially sponsor the Symposium without financial

cost to IAGA. The first announcement of the Symposium will be carried in IAGA News No. 8.

IUGG General Assembly in 1971 in Moscow

Lengthy discussions regarding the XV IUGG General Assembly were held. The discussion is summarized in the following memorandum which was immediately sent to the IUGG Executive Committee in time for its 13 September 1969 meeting in Madrid:

"IAGA has already sent notice to the IUGG Executive Committee that it would like to co-sponsor the following interdisciplinary symposia at the XV General Assembly:

1. Ocean Floor Spreading with IAPSO, IAG, IASPEI
2. Energetics and Dynamics of the Mesosphere and Lower Thermosphere with IAMAP
3. Physics of the Moon with IASPEI and IAVCEI

"In addition IAGA also proposes the following interdisciplinary symposia:

4. Solar Corpuscular Effects on Troposphere and Stratosphere with IAMAP
5. Electric Fields in Space and Their Connection with Atmospheric Effects with IAMAP
6. Automatic Acquisition of Data and Time Series Analysis, with all other Associations
7. Aurora and Airglow - All Aspects, with Commission on Airglow from IAU and Radio Aurora Commission of URSI (although these are not IUGG Associations they will probably want to cooperate)
8. Geomagnetic Aspects of the Structure and Evolution of the Earth and Planets.
9. Morphology and Physics of Magnetospheric Substorms
10. Lunar Variations in Geophysical Phenomena with IASPO, IAG and IAMAP

"Dr. Troitskaya who is a member of the IAGA Executive Committee and knows very well the desires of the USSR Local Committee indicates that there is plenty of room for IAGA to hold a full Association Assembly in Moscow. The IAGA Executive Committee strongly feels a need to do this because of its size and because of the importance of the program it represents. Holding a full scale Association meeting would permit the discussions of many extremely important topics which relate mainly to IAGA itself.

"It is therefore proposed that each IAGA Commission plan full activities for the Moscow Assembly. Each Commission will be encouraged to specify one or two topics for emphasis, but general contributions will also be encouraged along with business meetings for Working Groups and Commissions. Plenary Sessions of the Association will also be necessary so that elections and business can be properly completed."

Resolution

Resolutions of thanks for the fine work of all the local Spanish people, headed by Father Romañá, who helped make the Spanish Assembly so successful were unanimously approved. Many scientific resolutions were also approved. All of these resolutions will be duplicated in IAGA News No. 8 and in IAGA Bulletin No. 27, Transactions of the Madrid Meeting.

Nominations Committee

It was agreed that the following scientists should act as a nominating committee to prepare a slate of candidates to lead IAGA during the 1971-1974 period for consideration at the XV IUGG General Assembly to be held in 1971 in Moscow:

T. Nagata - President of IAGA (ex officio member and Chairman)

M. Nicolet - Past President of IAGA

V. Laursen - Past President of IAGA

IAGA-IAMAP Joint Committee on Atmospheric Electricity

The name "Planetary and Space Problems of Atmospheric Electricity," was approved for the 9th Working Group of the IAGA-IAMAP Joint Committee on Atmospheric Electricity. This is now official since it was approved earlier by IAMAP as indicated in a letter from Dr. Godson, secretary of IAMAP to Dr. Koenigsfeld dated 11 July 1969.

French Proposal

Each Commission Chairman expressed the view of their Commission regarding the French proposal. Many points of view were displayed. Most of these are shown in the minutes of the Commission business meetings which will be published in the transactions of the Madrid meeting.

No distinctive point of view was agreed upon. The only decision made on this point was that the only real problem within IUGG which prompted the French proposal is IAGA's relationships to IUCSTP, COSPAR, and URSI. Therefore IAGA must figure prominently in its solution.

The IAGA Executive Committee is continuing to explore solutions to this problem, and at the latest intents to have a mature point of view on May 1970.

It was recommended that IUGG be asked to appoint a committee to study this problem and that IAGA scientists be strongly represented on this study committee.

If later, an ICSU Committee is appointed to study this problem IAGA scientists should form a large part of the IUGG representation.

Next Meeting

The next meeting of the Executive Committee will be held at Leningrad at the time of the Interunion Symposium on Solar-Terrestrial Physics.

VI CHANGES IN COMMISSION MEMBERSHIP

(These changes should be applied to list given in IAGA News. No. 7)

COMMISSION I

Magnetic Observatories I₁

ADD: K. L. Svendsen (USA)

DELETE: J. Cain (USA)

Additional Commission Members not Assigned to Working Groups:

ADD: A. Adam (Hungary)

COMMISSION II

Rockets and Satellites II₃

ADD: K. Burrows (U.K.)

CHANGE: S. H. Hall (Gr. Britain)
to
S. H. Hall (Australia)

Data Interchange II₆

ADD: C. G. Sucksdorff (Finland)
H. Meyers (USA)
B. N. Bhargava (India)

Additional Commission Members not Assigned to Working Groups:

ADD: V. M. Mishin (USSR)

COMMISSION III

Electro-Dynamics III₁

DELETE: E. H. Vestine

Electromagnetic Induction III₃

ADD: I. Gough (Canada) Reporter

DELETE: K. Whitham (Canada)

Archeomagnetism III₅

ADD: R. L. DuBois (USA) Reporter

DELETE: E. Thellier (France)

Palaeomagnetism III₆

ADD: K. M. Creer (U/K/) Reporter

DELETE: R. R. Doell (USA)

Geomagnetic Anomalies III₇

ADD: W. Mundt (GDR)

COMMISSION IV
Magnetospheric Field Variations IV₆

ADD: V. L. Patel (USA)

COMMISSION V
Solar Wind Interaction with the Earth, Moon and Planets V₁

ADD: G. D. Mead (USA) G. A. Skuridin (USSR)

Morphology of Radiation Belts V₂

ADD: C. Bostrom (USA) G. Pizzella (Italy)
 F. Cambou (France) F. Soraas (USA)
 H. Ghielmetti (Argentina)

Particle-Field Interactions V₃ Reporter: L. R. O. Storey (France)

ADD: A. Eviatar (Israel) D. A. Gurnett (USA)
 R. Gendrin (France) J. F. Kenney (USA)
 C. -G. Fälthammar (Sweden) R. H. F. Lüst (GFR)

Cold Plasma and Low Energy Particles V₄

ADD: S. Bauer (USA) J. W. Freeman (USA)
 A. E. Belon (USA) H. Trefall (Norway)
 L. Block (Sweden) E. W. Hones (USA)
 V. M. Vasyliunas (USA)

Solar Energetic Particles and Cosmic Rays V₅

ADD: H. Carmichael (Canada) G. C. Reid (USA)
 R. Knuth (GDR) J. J. Quenby (Great Britain)
 S. M. Krimigis (USA)

Members of Commission not Attached to Specific Working Groups:

ADD: R. Gall (Mexico)

DELETE: C. O. Bostrom (USA) shown as member of Working Group V₂
 A. J. Masley (USA) shown as member of Working Group V₅
 G. C. Reid (USA) shown as member of Working Group V₅

COMMISSION VIII

Composition and Density Variations VIII₁

ADD: H. Kamiama (Japan)
C. A. Reber (USA)

DELETE: E. A. Lauter (GDR)
A. O. Nier (USA)

Winds, Gravity and Infrasonic Waves VIII₂

ADD: C. R. Wilson (USA)

Exospheric Problems VIII₃

ADD: J. H. Joseph (Israel)

Members of the Commission not Assigned to Specific Working Group:

ADD: A. O. Nier (USA)

VII NEW ADDRESSES

- Adam, A., Geophysical Research Laboratory of Hungaria, Academy of Sciences, P. O. Box 9, Sopron, Hungary
- Allredge, L. R., ESSA Research Laboratories, Boulder, Colorado 80302 USA
- Ashour, A. A., Department of Mathematics, Faculty of Science, Cairo University, Cairo, UAR
- Belon, A. E., National Science Foundation, 1800 G St., N. W. Washington, D. C. 20005 USA
- Barszus, M.H.G., c/o ORSTOM, Bureau of Geophysique, 24 rue Bayard, Paris 8, France
- Bombke, H., AMSEL-XL-S, U.S. Army Electronics Command, Ft. Monmouth, New Jersey 07703 USA
- Cahill, L. J., Jr., Director, Space Science Center, Minneapolis, Minnesota 55455 USA
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- Gjellestad, G. E., Universitetet i Bergen, Geofysisk Institutt, avd. C Allegt 70, 5000 Bergen, Norway
- Godson, D. W., Meteorological Service of Canada, 315 Bloor Street, W. Toronto 5, Canada
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- Hargreaves, J. K., Environmental Sciences Department, University, Lancaster, England
- Helbig, K., Research Director Geophysics, Texaco Belgium E.R.C., 31 Pres. J. F. Kennedylan, Gent, Belgium
- Hess, W. N., Manned Spacecraft Center, Houston, Texas 77001
- Hesstvedt, E. C., Astrofysisk Institut, Oslo Universitat, Blindern, Oslo 3, Norway
- Heuring, F. T., Geonautics Inc., 208 W. Broad Street, Falls Church, Virginia 22046 USA

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